



ERRATA sic Corrige.

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OXFORD,
Printed at the *THEATER*, and are to be sold by
Pit at the *Angel*, and *Samuel Smith* at the *Princes*
in *St. Pauls Church-yard* London. 1683.



PHILOSOPHICAL Transactions.

GIVING SOME

ACCOMPT

OF THE

Present Undertakings, Studies, and Labours,

OF THE

INGENIOUS

IN MANY

Considerable Parts

OF THE

WORLD.

VOL. XIV.

For the Year of our Lord, M.DC.LXXXIV.

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Jan. 20. 1683.

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1. *An account of the City of Prusa in Bithynia, and a continuation of the Historical Observations relating to Constantinople, by the Reverend and learned Tho. Smith D. D. fellow of Magd. Coll. Oxon. and of the Royal Society.*

Montanea formerly called Nicopolis, according to Bellerminius, or rather Cios, the bay hence called Sinus Cianus,

A

lies

lies in the bottom of a bay about fourscore miles from *Constantinople*, and is the scale or landing place for *Prusa*, from which it may be about twelve miles; in the middle way to which is the Village *Mouffanpoula*.

Prusa, now called by the *Turks* *Bursia*, the cheif City of *Bithynia*, is seated at the foot partly, and partly upon the rising of the mount *Olympus*, which is one of the highest hills of the lesser Asia. Its top is covered with snow for nine or ten months of the year, several streams of water flowing down the hill continually, accounted very unwholesome from the snow mixed with it. In the upper part of the City to the northwest lyes the Seraglio, which is walled round; but the Emperors not residing here since their acquits in *Thrace*, or scarce making visits to this Imperial City, and none of their sons living here of late, according to the former policy of the *Turkish* Emperors, who did not permit their sons, when grown up, to be near them, but sent them to some honourable employment, accompanied with a Bassa and Cadi to instruct them in the arts of War and Government, it lyes now neglected and dispoyled of all its ornaments.

In this part also are the Sepulchers of *Osman*, the founder of the family, which now reigns, and his son *Urchan*, who took the City, near a Moich, formerly a *Christian* Church dedicated to St. *John*, and where was formerly a Convent of Religious, built by *Constantinus Iconomachus*, where I saw the figure of a Cross still remaining upon the wall. Here hangs up a Drumm of a vast bigness, such as they carry upon the backs of Camels, and I suppose is one of those, which they used in the taking of the place.

In the lower part, near the bottom of the hill, *Morad* the second, the Father of *Mahomet* the Great, lyes buried: near whereunto was formerly the Metropolitcal Church of the *Holy Apostles*. The *Bezeften*, or Exchange seems to be much better and larger than the great one at *Constantinople*, as are the several Caravanserais built for the use

use and accommodation of Merchants, and Travellers; in one of which, the Rice Chane, I took up my quarters.

Without the City toward the east is the Mosch and Sepulcher of the Emperor *Bajazid* the first, whom the *Turks* call *Jilderim* or lightning, and the Greek Writers *αἰλακός*. Not far from hence is the Mosch of *Mahomet* the first, and his Sepulcher. Toward the west upon the side of the hill is the Mosch of *Morad* the first, whom they call *Gazi* or the Conqueror, near which he lyes buried. There are in the whole about 124 Moschs, several of which were formerly *Christian* Churches, and between fifty and sixty Chanes. The Castles built by *Osman*, when he besieged the City, are slighted and altogether unfortified, the one to the north, the other to the south-west.

At *Checkerghe*, about a mile and a half out of Town, are the hot Baths, much frequented both by *Christians* and *Turks*. They are made very convenient to Bath in, and are covered over, that they may be used in all weathers. Among others, there is a large round *Basin*, where they usually divert themselves by swimming.

What opinions the *Turks* have of our B. Saviour and the *Christian* Religion, I shall briefly shew, as they lye dispersed in several chapters of the *Alcoran*, according to which they frame their discourse whensoever either zeal or curiosity puts them upon this topick. For *Mahomet* upon his setting up to be the Author of a new Religion, finding such a considerable part of the World professing the doctrine of *Christ*, with all the mysteries of faith therein contained, was cast upon a necessity of saying something both concerning him and it. By which it will appear, how great the power of truth is above imposture and subtilty, and that as the Devils in the possessed confess't, though against their wills, *Christ* to be the son of God, so this *Demoniack* in the midst of all his forgeries, and lyes, and ridiculous and childish narratives, not being able to

contradict the universal belief of the *Christians* of that, and the preceeding ages, founded on the history of the Gospel, hath been forced to give testimonie to several particulars of it.

They confesse then that *Christ* was born of a pure spotless Virgin, the Virgin *Mary*, chosen by *God* and sanctified above all the women in the World; and that the Angel *Gabriel* was dispatched out of Heaven to acquaint her with the news of it. That such a kind of miraculous and supernatural birth never hapned to any besides, and that *Christ* was conceived by the *Holy Ghost*, and that he wrought mighty miracles, for instance, that he cleansed lepers, gave sight to the blind, restored sick persons to their health, and raised the dead.

That he is a great Prophet, sent by *God* to convert men from the vanity and error of their false worship to the knowledge of the true *God*, to preach righteousness, and to correct and restore the imperfection and miscarriages of humane nature; that he was of a most holy and exemplary life, that he was the true word of *God*, the *Apostle* or *Ambassador* of *God*: that his Gospel was revealed to him from Heaven, and that he is in Heaven standing nigh to the throne of *God*. They blaspheme indeed with a brutishness and stupidity only befitting *Turks*, the mysteries of the *holy Trinity*, and of the divinity of our *B. Saviour*, and deny that he was put to death, and say that another in his shape was crucified by the *Jews*, and that he himself was assumed into Heaven in his body without dying at all, and consequently they will not own, that he satisfied divine justice for the sins of the World; so great an affinity is there between the heresy of *Socinus* and profess't *Mahometanism*.

I could never yet see any *Turkish* translation of the *Alcoran*; they cry up the elegance of the style, which being Enthusiastick and high-flown, by reason also of the tinkling of the periods, is very delightful to their ears, who
seem

seem to be affected with rythme mightily. Though I suppose it is upon a more politick accompt, that they are so averse, as to the translating it into their vulgar language, not out of respect to the sacredness of the original only, whose full commanding expressions they think cannot be translated without a great diminution to the sense; but to keep it in greater veneration among the people, who might be apt to slight and disesteem it, should it become thus common among them. It is enough, that the Priests and learned men explain the difficult passages of it to the people, and write Commentaries for the use of the more curious and inquisitive. The *Persians* on the contrary think it no disparagement to the *Arabick*, or profanation of the sense to translate this cursed book into their own language, and copies are frequent among them.

The *Grand Signors* women are usually the choicest beauties of the *Christian* spoiles, presented by the *Bassa's* or *Tartars*. The present *Sultana*, the mother of the young Prince *Mustapha*, is a *Candiot*; the *Valide* or Emperors mother, a *Russian*, the daughter of a poor Priest, who with her relations were seized upon by the *Tartars* in an incursion, which they made into the *Muscovites* Country. She being received into the *Seraglio*, by her beautiful complexion and cunning behaviour, gain'd the heart and the affection of *Sultan Ibrahim*. (a man wholly addicted to soft pleasures, and who seldome cared to be long absent from the womens apartment, but chose to spend his time among them) Having the good fortune to be the mother of the Prince *Mahomet*, the eldest son of his father, who now reigns, She had all the honors that could possibly be done her, and was the beloved *Hazaki* or chief Concubine. During this height of splendor and glory, the Court removing from *Constantinople* to *Adrianople*, distant about an hundred and twenty miles, as she was passing in great state attended with her Guards, through the streets of the City, in a Coach much like our carriage wagons,

wagons, but that they are latticed to let in the air (for no one must presume to stare or scarce look upon the women, much less must they themselves suffer their faces to be seen in this jealous Country) she out of curiosity looking through the holes, saw a poor *Christian* slave in a shop, where sugar and such like wares were sold. Upon her return she sent one of her Eunuuchs to enquire for the person, and to ask him several questions about his Country, relations, friends, and the time when and how long he had been a slave: his answers were so particular and satisfactory, that she was soon convinc'd of the truth and certainty of her apprehensions, when she first cast her eyes upon him, that he was her brother, and accordingly it proved so. Whereupon acquainting the Emperor with it, she immediately redeemed him from his Patron, and having made the poor wretch turn *Turk*, got him considerably preferred.

The Bassa's for the most part are the sons of *Christians*, taken into the *Seraglio*, near the Emperors person, and so are prefer'd to considerable Governments, or else they raise themselves by their Conduct and Valour. *Mahomet* Bassa in the time of *Achmet*, whose eldest daughter he married, was the first natural *Turk*, that was made chief Vizir, having before been Captain Bassa. The chief Vizir *Mahomet Kupriuli*, (who settled the Empire in the minority of this Emperor, when it was ready to be shaken into pieces, and dissolved by several powerful factions in the State, and by the mutinies and discontents of the *Janizaries* and *Spah's*, who drove different ways) was an *Albanese* by birth, the son of a *Greek* Priest, whom out of the height of his zeal for *Mahomet*, he made turn *Turk* in his old age, and converted the *Christian* Church in the Village where he was born, into a Mosch. This man also forbade the *Dervises* to dance in a ring and turn round, which before was their solemn practise at set times before the people, which they would do so long, till they were giddy by this swift circular motion, and fell down in a swoon, and then oftentimes upon their recovery from such trances they pretended to revelation. The Churchmen are not very kind to his memory, looking upon him as a man of little or no religion; and they give out, that if he had lived, he would have forbid their calling to prayers from the spires of their Moschs, and hanging out Lamps; both which they look upon as solemn and essential to the exercise of religion; but he as the effect of bigotry and superstition.

They

They have a mighty honour and esteem for Physicians, for though they are of opinion, that they cannot with all their art prolong life, the period and term of it being fatal and absolutely determin'd by God, yet they often consult them upon any violent sickness or pain, in order to make the time allotted them in this world more pleasant and easy. It is extraordinary rare, that a natural *Turk* makes Physic his profession and study. They who practise it among them, when I was in *Turkey*, were for the most part *Greeks* and *Jews*, who know nothing of chymical Medicines, but follow the usual methods, which they learnt in *Italy* and *Spain*, the former having studyed in *Padua*, and the latter in *Salamanca*, where they pass t for good *Catholicks*. And I remember I met with a certain *Jew* Physician, who had been a *Capucine* in *Portugal*. During the tedious siege of *Candia*, the *Vizir*, what with melancholy, and what with the ill air of the Camp, finding himself much indispos'd sent for a *Christian* Physician *Signor Massalini*, a subject of the Republick of *Venice*, but married to a *Greek* woman, by whom he had several children, who was our neighbour at *Pera*, an experienced able man, to come speedily to him, and made him a present of about a thousand Dollars, in order to fit himself for the voyage and bear the expence of it. By this worthy Gentlemans care, he recovered his health, and would not permit him to depart, till after the surrendry of that City, which might be about seven months after his arrival there, treating him in the mean while with all imaginable respect. During our short stay at *Bursia*, one of our *janizaries* accidentally discoursing with a *Turk* about us, whom they knew to be *Franks*, told him that there was a Physician in the company, who had been lately at the Grand Signors Court at *Saloniki* with the *English* Ambassador, and was now upon his return from *Constantinople* to *Smyrna*, where he lived. This presently took vent, and the *Turks* thought that they had got a man among them, that could cure all diseases infallibly; for several immediately came to find us out in behalf of themselves or their sick friends, and one of the most considerable men upon the place, desired the Doctor to go to his house to visit one of his women sick in bed, who being permitted to feel her naked pulse (for usually they throw a peice of fine silk or curle over their womens wrists at such times) soon discovered by that and other symtoms and indications of her distemper, that opening a vein would presently give

give her ease and recover her: which he did accordingly; for which he received an embroidered hancherchief instead of a fee, and gained the reputation of having done a mighty cure.

They have little of ingenious or solid learning among them; their chief study, next to the *Alcoran*, being metaphysical niceties about the Attributes of God, or else the maintenance of other odd speculative notions and tenents, derived down to them from some of their famed masters and holy men, whom they pretend to follow. Their knowledge of the motion of the heavens, for which the *Arabians* and the other eastern Nations have been so deservedly famous, as their Astronomical tables of the Longitude and Latitude of the fixed Stars, and of the appulse of the moon to them, fully evince, is now very mean, and is chiefly studied for the use of Judiciary Astrology. The great instrument they make use of is an Astrolabe, with which they make very imperfect observations, having no such thing as a Quadrant or Sextant, much less a Telescope, or any mechanical engine, to direct and assist them in their calculation. Their skill in Geography is as inconsiderable; I remember I heard the Captain Bassa, whom they stile Admiral of the black and white Seas, meaning the *Euxine* and the *Mediterranean*, ask this silly question, whether *England* were out of the straits: and at another time the *Caymacan* or Governor of *Constantinople*, hearing that *England* was an Island, desired to know, how many miles it was about, in order, we supposed, to make an estimate of our Kings greatness and strength by the extent and compass of it.

One of the great Astrologers of *Constantinople*, having heard that I had a pair of Globes in my chamber, made me a visit on purpose to see their contrivance, being introduced by a worthy Gentleman of our own Nation. After the first ceremonies were over, I took my Terrestrial Globe, and rectified it to the position of the place, and pointed to the several circles both without and upon it, and told him in short the several uses of them: then shewed him how *Constantinople* bore from *Candia* at that time besieged, *Cair*, *Aleppo*, *Mecca* and other chief places of the Empire, with the other parts of the World: at which he was mightily surpris'd to see the whole Earth and Sea represented in that figure and in so narrow a compass, and pleased himself with turning the Globe round several times together. Afterwards I set before him the Celestial

lestial Globe, and rectified that, and shewed him how all the noted Constellations were exactly described, and how they moved regularly upon their poles, as in the Heavens ; some rising, and others setting, some always above the Horizon, and others always under, in an oblique sphere, and particularly what Stars would rise that night with us at such an hour ; the man seemed to be ravished with the curiosity of it, turning this Globe also several times together with his finger, and taking a mighty pleasure in viewing the motion of it ; and yet this silly Animal past for a Conjuror among the *Turks*, and was lookt upon as one, that could foretell the events of battels, the fates of Empires, and the end of the World.

They have no genius for Sea-voyages, and consequently are very raw and unexperienced in the art of Navigation, scarce venturing to sail out of sight of land. I speak of the natural *Turks*, who trade either into the *black Sea* or some part of the *Morea*, or between *Constantinople* and *Alexandria* ; and not of the Pyrats of *Barbary*, who are for the most part Renegado's, and learnt their skill in *Christendom*, which they exercise so much to the terror and damage of it. A *Turkish* compass consists but of eight points, the four Cardinal and four Collateral ; they being at a mighty loss how to sail by a side wind, when by hauling their sailes sharp, they might lye their course, and much more, when they are in the winds eye, not knowing how to make tacks and bords, but choose rather to make halt into some neighbouring Port, till the wind blows fair. An *English* and *Turkish* Vessel both bound for the bay of *Saloniki*, at the time of the Grand Signors being there, past together out of the *Hellepont* ; but foul weather hapning, the *Turks* gott into *Lemnos* ; while our men kept at Sea and pursued their Voyage, and after three weeks stay returned back to us, observing in their way, that the *Turks* remained in the same place where they left them, for want of a fore-wind to put to Sea in.

They trouble not themselves with reading the Histories of other Nations or of antient times, much less with the study of *Chronology*, without which History is very lame and imperfect ; which is the cause of those ridiculous and childish mistakes, which pass current and uncontradicted among them. For instance, they make *Job* one of *Solomons* Judges and (*Iscander*) *Alexander* the Great Captain General of his Army. They number *Philip* of *Macedon* among the ancestors of our *B. Savi-*

our, and believe that *Sampson*, *Jonas*, and *St. George* were his contemporaries. In this they are more excusable than their false Prophet *Mahomet*, who in his *Alcoran* has perverted several Historical notices in the writings of the Old Testament, and is guilty of vile and absurd pseudo-chronismes. To remedy this defect of which he was very conscious, and the better to understand the state of *Christendom* and the particular Kingdoms and Republicks of it, the late great and wise *Vizir*, *Achmet*, made his interpreter *Panagiotti*, a learned Greek, at leisure houres, even at the siege of *Candia*, as well as at other times, read several ancient histories to him. and render them extempore into the *Turkish* language, and particularly *Blaeus Atlas*, with which he was mightily pleased, and made great use of, and truly gained the reputation of a solid and judicious Statesman, as well as Souldier among the *Christian* Ministers, who in the ordinary course of their negotiations apply'd themselves to him.

Tho their year be according to the course of the moon, and so the *Turkish* months run round the civil year in a circle of thirty three years and a few odd days, yet they celebrate the *Neuruz*, which signifies in the *Persian* tongue the new year, the twenty first day of *March* (on which day the vernal equinox was fixed by the *Greeks* and other *Oriental Christians*, in the time of the Emperor *Constantine*, who made no provision for the *anomalis conjunction* or precession, which in process of time the inequality between the civil and Astronomical year must necessarily produce) at which time the *Cadyes* and other annual Magistrates, and Farmors of the customes take place, and reckon to that day twelve month again.

In their Civil deportment and behaviour one towards another, the left hand is the more worthy and honourable place, except among their Ecclesiasticks; and the reason they alledge is, because they write from the right hand, and the sword is worn on the left side, and so is more at his disposal, who walks on that hand. The chief *Vizir* accordingly in the *Divan* sits at the left hand of the *Muphy*, each maintaining their right of precedence according to this way of decision.

In their Moschs they sit without any distinction of degrees. Some of the more zealous *Turks* cause to be engraven on their Scymitars and Bucklers a sentence out of the sixty first *Surat*, which is concerning fighting or battle-array, and contains encouragements to fight in the way and path of God, as the

Impostor

Impostor words it; for which he assures them, besides assistance from Heaven to help them to get the victory over their enemies, and that *God will pardon their sins and bring them to paradise*. Thus spirited with zeal, a *Turk* lays about him with fury, when he is a fighting, and seems ambitious of dying to gain the delights of Paradise, at least indifferent whether he dyes or lives.

The *Turks* are as to their temper serious, or rather inclining to morosity, seldom laughing, which is accounted an argument of great vanity and lightness. They perform the exercises, which they use in the way of diversion, as shooting and hunting, with a great deal of gravity, as if they designed them more for health than for pleasure; and this too but seldom. The better and richer sort, who have nothing to do, sitting all day at home, lolling upon a Sofa or rais'd place in their rooms, and taking Tobacco, which their slaves fill and light for them: and if they retire in the Summer or Autumn, for a week or fortnight to some convenient fountain in a wood with their women, it is chiefly to enjoy the refreshments of the cool air. In the times of triumph indeed for some great success obtained against the *Christians*, when the shops are open for three nights together, and hung with lights, as well as the spires of the Moschs in curious figures, they are guilty of extravagant mirth, running up and down the streets in companies, and sometimes singing and dancing after their rude way; but this fit being over, they soon return to their former melancholy. In the Coffee-houses where they use to resort to tiple, there is usually one hired by the owners to read either an idle book of tales, which they admire as wit, or filthy obscene stories, with which they seem wonderfully affected and pleased, few of them being able to read. These are the schools, which they frequent for their information, tho in times of war, when things went ill with them, their discourses would be of the ill Government; and the Grand Signor himself and his chief ministers could not escape their censures, which manifestly tending to sedition, and to the heightening of their discontents by their mutual complaints, and by this free venting of their greivances during the war at *Candia*, the wise Vizir seeing the evil consequences that would follow, if such meetings and discourses were any longer tolerated, commanded, that all the publick Coffee-houses should be shut up in *Constantinople* and several other great Cities of the

Empire, where the malecontents used to rendezvouz themselves, and find fault upon every ill success and miscarriage with the administration of affairs.

The custome of the *Turks* to salute the Emperor or the *Vizir Bassa's* with loud acclamations and wishes of health and long life, when they appear first in their houses or any publick place, is derived from the *Greeks*, who took it from the *Romans*. This was done by them in a kind of singing tone; whence *Luitprandus* Bishop of *Cremona* tells us, that in a certain procession (*προέλυσις*) at which he was present, they sang to the Emperor *Nicephorus* πολλά ἔτη that is, many years, (which *Codinus*, who lived just about the taking of *Constantinople*, by the *Turks*, expresses by τὸ ψάλλειν τὸ πολυχρόνιον or by τὸ πολυχρονίζειν, and the wish or salute by πολυχρόνισμα) and at dinner the *Greeks* then present wish'd with a loud voice to the Emperor and *Bardas*, *Ut Deus annos multiplicet*, as he translates the *Greek*.

The *Turkish* coyn in it self is pitiful and inconsiderable, which I ascribe not only to their want of Bullion, but in their little skill in matters relating to the mint. Hence it comes to pass, that *Zecchines* and *Hungars* for Gold, and *Spanish Dollars* and *Zalotts* for Silver stamp'd in *Christendom* pass current among them, most of the great payments being made in them, they not caring either through ignorance or sloth to follow the example of the *Indian* or *Persian* Emperors, who usually melt down the *Christian* money imported by the Merchants into their severall Countreys, and give it a new stamp. The most usual peices are the *Sheriphi* of Gold, somewhat less in value then a *Venetian Zecchine*, and *Aspers*; ten of which are equal to six pence *English*, and some few three *Asper* peices. A mangur is an ugly old Copper peice, eight of which make but one *Asper*, and is not I think a *Turkish* coyn, but rather *Greek*. They have no armes upon their coyn, only letters embossed on both sides, containing the Emperors name, or some short sentence out of the *Alcoran*.

The *Turks* look upon Earthquakes as ominous, as the vulgar do upon Eclipses, not understanding the Philosophy of them. During my stay in *Constantinople*, which was above two years, there hapned but one which was *October 26. 1669.* about six a clock in the morning, a stark calme preceeding. It lasted very near a minute, and we at *Pera* and *Galata* were as sensible of it, as those who were on the other side of the water; but praised be God, nothing fell and we were soon
rid

rid of the fears in which this frightful accident had cast us, being in our beds, and not able by reason of the surprize in so little a space to have past through a Gallery down a pair of Stairs into the Court, if we had attempted it. The Turks made direful reflexions on it, as if some calamity would inevitably fall upon the Empire, quickly forgetting the great triumphings and rejoycings which they exprest but a few days before for the Surrendry of *Candia*. In the year 1668, in *August*, the Earth shook more or less for forty-seven days together in the lesser *Asia* at *Anguri* (*Ancyra*), and for fifteen at *Bachasar*, as we heard from a *Scotch* Merchant, who liv'd there: and particularly, that at this latter place on the second of *August*, between three and four of the Clock in the afternoon it lasted for a quarter of an hour; several houses were overthrown, and some hundreds of Chimneys fell (it being a very populous Town) and yet there were but seven kill'd. The trembling being so violent, both *Turks* and *Christians* forsook their Houses, and betook themselves to the Fields, Vineyards, and Gardens, where they made their abode for several days.

Their punishments are very severe, this being judg'd the most effectual way to prevent all publick disorders and mischiefs. They use no great formality in their processses: if the Criminal be taken in the Fact, and the witnesses ready and present to attest it, and sometimes if there be but probable circumstances, without full conviction, condemn him; and soon after sentence, sometimes an hour or less, hurry him away to execution. For an ordinary crime, hanging is the usual death: but for Robbery and Murder, committed upon the high way by such as rob in Parties and alarm whole Provinces, or for Sacrilege, or for any hainous Crime against the Government, either Gaunching or Excoriation, or cutting off the Legs and Arms, and leaving the Trunk of the Body in the high way, or Empaling, that is, thrusting an Iron stake through the Body out under the Neck or at the Mouth; in which extreme torment the miserable wretch may live two or three days, if the Guts or the Heart happen not to be wounded by the pointed spike in its passage. This punishment seems to have been in use among the Romans, *Seneca's* Epist. 14. *Cogita hoc loco carcerem, & cruces, & eculeos, & uncum, & adactum per medium hominem, qui per os emergat, stipitem*: and so in his Book *De Consolatione ad Marciam* cap. 20.

Alii

Alii capite conversos in terram suspendere : alii per obscena stipitem egerunt : alii brachia patibulo explicuerunt. Murder is seldom pardon'd, and especially if the Relations of the murder'd person demand Justice.

The Circumcision, tho it be a sacred Rite, is perform'd in their private Houses, and never in the Moschs.

The Women colour their Eye-Brows and Lids with an ugly black powder, I suppose, to set off their beauty by such a shadow ; and their nails with the powder of *Kanna*, which gives them a tincture of faint red, like Brick (as they do the Tails and Hoofs of Horses) which they look upon as a great ornament. Their great diversion is Bathing ; sometimes thrice, if not four times a week. They do not permit them to go to Church in time of Prayer, for fear they should spoil their devotion : The *Turks* being of so brutish a temper, that their Lust is rais'd upon the sight of a fair object, They are call'd oftentimes by the Names of Flowers and Fruits, and sometimes phantastic Names are given them, such as *Sucar Birpara*, or bit of Sugar, *Dil Ferib*, or Ravisher of Hearts, and the like.

Their skill in Agriculture is very mean. In their Gardens they have several little Trenches to convey water, where it may be most necessary for their Plants and Flowers. They know little or nothing of manuring their Grounds: sometimes they burn their Fields and Vineyards after Harvest and Vintage, partly to destroy the Vermin, and partly to enrich the Soil. They tread out their Corn with Oxen, drawing a square plank board, about a foot and half or two foot over, studded with Flints, and winnow it upon their threshing Floors in the open Air, the wind blowing away the Chaff. They feed their Horses with Barly and chopt Straw ; for I do not remember ever to have seen any Oats among them ; and they make but little Hay.

For draught of great weight in their Carts they make use of Buffalo's.

Camels will endure Travel four days together without water, and will eat tops of thistles, shrubs, or any kind of boughs : they are very sure footed, and kneel when they are a loading, and live to a considerable number of years, some even to sixty.

The chief Furniture of their Houses are Carpets, or Mats of *Grand Cairo*, neatly wrought with Straw, spread upon the ground ;

ground ; they having no occasion of Chairs, Couches Stools, or Tables ; their postures within doors, being different from ours. They have no Hangings, but their walls are whited and set off with painting, only adorn'd with a kind of Porcelane ; no Beds clos'd with Curtains.

They seal not with Wax, but Ink, at the bottom of the Paper, the Emperor's Name being usually written with flourishes and in perplexed characters : Nor have they any Coats of Arms upon their Seals, there being no such thing as Gentility among them.

Some of them, notwithstanding their zeal for *Mahomet* and the Religion by him establish'd, retain not only a favourable and honourable opinion of our Blessed *Saviour*, but even place some kind of confidence in the usage of his Name, or of the words of the Gospel, tho it may seem to be wholly in the way of Superstition. Thus in their Amulets, which they call *Chaimaili*, being little bits of Paper of two or three fingers breadth, roll'd up in pieces of Silk, containing several short prayers or sentences out of the *Alcoran*, with several Circles with other figures, they usually inscribe the holy and venerable Name of *JESUS*, or the figure of the Cross, or the first words of St. *John's* Gospel, and the like. They hang them about their necks, or place them under their Arm-pits, or in their Bosom near their Hearts (being the same with what the *Greeks* call *εγκόλπια*) and especially when they go to War, as a preservative against the dangers of it ; and indeed against any misfortune whatsoever. Some have them sow'd within their Caps : and I heard of a *Turk* who was so superstitious herein, that he always pluckt it off, and was uncover'd, when he had occasion to make water. Some are such Bigots in their Religion, and so furious against Christians, that not only they treat them with all imaginable scorn and contempt, but take it ill to be salam'd or saluted by them, as if it were the effect of fawning or unbecoming familiarity. Their malice against the Christians makes them envy the rich Furs they line their Vests with, and it is a trouble to these hypocritical Zealots to see the *Franks* ride upon their fine *Arabian* Horses.

The respect which they shew the *Alcoran* is wonderful : they dare not open the Leaves of it with unwashen hands, according to the advice or command written in *Arabic* upon the

the Cover, *Let no one touch this Book, but he that is clean.* They kiss it, and bend their heads and touch their eyes with it, both when they open it and shut it.

The *Fanizaries*, when they attend upon *Christian Ambassadors* to their Audience, seem to appear in their Bravery, and in a Habit far from that of a Soldier, being without either Fire-Arms or Swords (which later are not worn but in time of service, or when they are upon a march, or embodied, wearing a Cap made of Camels hair, with a broad flap dangling behind, a gilt embroider'd wreath running round it, and an oblong piece of Brass rising up from the middle of their forehead near a foot, with a great Club in their hand, like inferior Officers of the Civil Government. But when they are in the Camp, they throw off their upper Vest, and Turbants, which they wear at all other usual times, as troublesome, and put on a *Fesi*, or red Cap, which fits close to their head, and tuck up their *Duliman* or long Coat, to their Girdle, that they may be the more quick and expedite in their Charge.

They affect finery and neatness in their Clothes and Shashes; not so much as a spot to be seen upon them, and in rainy or suspicious weather, are very careful how they go abroad without their *Tamurlicks*, which is a kind of Coat they throw over their heads at such times.

Their Pans and Dishes are for the most part of Copper, but so handsomely Tinn'd over, that they look like Silver.

There are thousands of Gypsies or *Zingaries* in Turkey, who live the same idle nasty kind of life, as they do in *Christianity*, and pretend to the same art of telling Fortunes; and are lookt upon as the offscouring of mankind. It is accounted the extremest point of human misery to be a slave to any of this sort of Cattel.

The *Haggi*, or Pilgrims, that have been at *Mecca* and *Medina*, forbear to drink Wine most religiously, out of a perswasion, that one drop would efface all the merits of that troublesome and expensive journey; and some have been possess'd with such a mad zeal, that they have blinded themselves after their been blest with the sight of *Mahomet's* Sepulcher.

After *Fatzeh*, that is, an hour and a half in the night, throughout the whole year, there is as great a silence in the streets as at midnight: the Emperor *Achmet* in the year

year 1611, having made an order, that no one should presume to be out of his house after that time ; which is to this day most punctually observed. The *Bostangi bashi*, who has the command of all the *Agiamoglans* in the *Seraglio*, the *Topgibashi* or such great Officers attended with a great train of armed Men, walking the Rounds, and drubbing such as they find abroad at unseasonable hours of what Nation or Quality soever, except Physicians, Surgeons, and Apothecaries, whom they allow at all times to visit the sick.

The *Turkmen*s, (for so they are peculiarly called, as if they were the true Descendents of the old *Turks* or *Scythians*, whose wandering kind of life is described by the Poet.

Ἀλλ' οἱ βίβιοι } Nulla domus, plaustri habitant, migrare per arva
Mos, atq; errantes circum-vestare penates.)

have no fixt residence any where, but travel with their Families and Cattle from place to place, carrying their Wives and Children upon Camels ; they pitch their Tents usually near Rivers and Fountains, for the convenience of water, and according as their necessities require, make a longer or a shorter stay, Their whole Estate consists in their numerous Flocks and Herds, which they sell upon occasion to supply themselves with what they want, at the Towns they pass by. Their only concern is how to enjoy the Benefits and Blessings of Nature, without the troubles and turmoys and disquiets of life ; being contented and happy in one anothers Company, void of all ambition and envy, courteous and humane to Strangers, that may want their Help and Assistance, kindly entertaining them with such Provision, as their Folds afford. I have met with some companies of these harmless wanderers in my Travels. The Country lies open without any Inclosures, and the propriety not being vested in any one, they travel thro the Plains unmolested, and find excellent pasturage every where. The *Turks* till no more ground then will serve their necessities : being supplied with Corn from *Egypt*, and from *Moldavia* and *Walachia*, by the way of the black Sea, letting vast tracts of ground lie wast and uncultivated ; so that their Sloth herein sometimes is justly punished with Dearth.

They have nothing to shew for their Houses and Possessiour, but an *Hogiet* or piece of Paper subscribed by the *Cadi*, if they have acquired them by their mony, or that they were their Fathers before them.

The *Dervises* generally are melancholy, and place the greatest part of their Religion in Abstinence and other Severities. Some cut their flesh, others vow not to speak for fix or seven years, or all their lives long, tho never so much provoked or distressed. Their Garments are made of a coarse sort of Wooll or Goats Hair: they are tied up by the vow of their Order ever from marrying. Several of this Sect in the height of their religious Phrenzy have attempted upon the lives of the Emperors themselves, (at whose Government they have taken disgust) as *Mahomet* the second, and *Achmet*, as if such desperate Attempts were fatal to Bigots in all Religions.

They pay a mighty Veneration to any Relique of *Mahomet*, his Banner is still preserved in the Treasury of the *Scraglio*, and is lookt upon as the great Security of the Empire. They believe that it was sent from Heaven, and conveyed into the hands of *Mahomet*, by the Angel *Gabriel*, as a Pledge and sign of Success and Victory in his Battels against the *Christians*, and all other Enemies of the *Musulman* Faith. It was sent to *Candia* to encourage the Soldiers to endure the fatigue of that long and tedious Siege; and when it was brought thence after the surrendry of that City, to be deposited in its usual place, the *Vizir* gave several *Christian* Slaves, that row'd in the Gally that was fraught with this holy Ware, their liberty. They pretend to have some Rags of *Mahomet's* Vest, to which they ascribe great Virtue. In confidence of which, the Emperor *Achmet*, in the time of a great Fire, which raged at *Constantinople*, when all other means fail'd, dipt part of them in water to be sprinkled upon the fire to rebate the fury of it.

Next to the *Mufti* or *Cadaleskires* are the *Mollas*, of which these four are the chiefest in Dignity. The Molla of *Galata*, *Adrianople*, *Aleppo*, *Prusa*; and after them are reckoned these eight, *Stambol Ephendi*, *Larissa*, *Misir* or *Cairo*, *Sham* or *Damascus*, *Diarbekir* or *Mejopotamia*, *Cutaia*, *Sophia*, *Philippi*.

The Priests have no habit peculiar to their Profession, whereby they are distinguish'd from others. If they are put from their Moschs for miscarriage or neglect of doing their duty, or if they think fit to resign and be Priests no longer, they may betake themselves without any scandal to secular Employments, their former Character and Quality wholly ceasing. While they remain Priests, they counterfeit a more then

then ordinary gravity in their discourse and walking : and affect to wear Turbants swelling out, and made up with more cross folds : which was all the difference which I could observe by their head Attire, which is various, tho I could not find that this was constantly and strictly observed.

In *Byram* time, which is the great festival of the year, at which time every one looks cheerfully and merrily, among other signs of mutual Respect, they besprinkle one another with sweet water. They indulge to several sports : and some are mightily pleased with swinging in the open air, the ordinary sort of people especially, paying only a few Aspers for the diversion.

The Government is perfectly arbitrary and despotical ; the Will and Pleasure of the Emperour having the force and power of a Law, and oftentimes is above it. His bare Command without any process is enough to take off the head of any Person, (tho never so Eminent in Dignity : tho usually for formality and to silence the murmurings of the Soldiery and People, the Sentence is confirmed by the *Musti*) Sometimes *Basas* who have amassed great treasures in their Governments, are cut off in their own houses in the midst of their Retinue, the Messengers of death producing the imperial Command, usually sent in a black purse, and not a sword drawn in their defense. Others, if they are obnoxious to the least Umbrage or Jealousie, tho dismiss the *Seraglio* with all possible demonstrations of the grand Signior's Favour, and with rich Presents in order to take possession of places of great command in the Empire, before they have got two or three days journey from *Constantinople*, have been overtaken and strangled. In the Army Commands are given according to merit, Courage and Conduct are sure to be rewarded, the way lying open to the meanest Soldier to raise himself to be the chief of his order. But other Preferments depend upon meer chance, and upon the fancy of the Emperour, whether the Person be fit or no, and they are as soon lost. The least ill success or miscarriage proves oftentimes fatal, and a more lucky man is put in his place, and he succeeded by a third, if unfortunate in a design, tho managed with never so much Prudence and Valour. They admit of no hereditary Honours, and have no respect to Descent or Blood, except the *Ottoman* Family : he only is great and noble, whom the Emperor favours, and while his Command lasts. Accord-

ing to a tradition, that passes current amongst them, a Bassa's Son by a *Sultana* or a Daughter or Sister of the Emperour can rise no higher then to to be a *Sangiacbei* or Governour of some little Province, much inferior to a Bassa and under his jurisdiction. Being born of Slaves for the most part, they do not pride themselves in their Birth, very few among them being scarce able to give any account of their Grandfathers. They have no Sirnames, but are distinguished by their possessions and places of abode, and enjoying by law a liberty of having what women they please, they have little or no regard to Alliance or Kindred.

Their Empire owes the continuance of its being to the severity of the Government, which oftentimes takes place without regard either to Justice or Equity, and to their frequent Wars, which prevent all occasions of mutiny and faction among the Soldiers, which happen frequently when unemploy'd. So that tho ambition may put a warlike Sultan upon enlarging his territories by new Conquests, yet reason of state forces a weak and effeminate Prince, such as was *Ibrahim*, to make War for his own security. Their politicks are not owing to Books and Study and the Examples of past times, but to experience and the plain suggestions of nature and common sense: They have Rules of Government, which they firmly adhere to, holding the reins strait, especially being cruel and inexorable to criminals of state, who never are to expect any mercy or pity. Their Councils formerly were open, and their Designs known, and proclaimed before hand, as if this had been a bravery becoming their greatness, and that they scorned to steal a Conquest. But they have learned since the Art of dissimulation, and can lye and swear for their Interest, and seem excessive in their Caresses to the Ministers of those Countries, which they intend to invade. But their preparations for arming are made with so much noise, that an ordinary jealousy is soon awakened by it to oppose them, in case of an Attaque. They seldom or never care to have War at both extremes of the Empire at the same time, and therefore they are mighty solicitous to secure a peace with *Christendome*, when they intend a War upon the *Persian*: and as much as is possible, they avoid quarrelling with two Christian Princes at once, being usually at league either with *Poland* and *Muscovy*, when they war upon *Hungary*, and so on the contrary; dreading nothing more then an Union of the *Christian* Princes,

Princes, bordering upon them, which would prove so fatal to their Empire, and quickly put a Period to their greatness. For hereby they would be put upon a necessity of making a defensive War to their great loss and disadvantage, and at last either be forced to beg a Peace of the *Christians*, or run the hazard of loosing all by a further prosecution of War.

This they are very sensible of, and therefore as they take all occasion to promote Quarrels and Dissentions in *Hungary* and *Transylvania*, so they greatly rejoyce, when the Princes of *Christendome* are at War one with another. This is their great time of advantage, and they know, that it is their true interest to pursue it, tho they do not always, by reason of the ill condition of their own Affairs. make use of it. During the Civil Wars of *Germany*, the Bassas and other Commanders of the Army were very importunate with the grand Signor, to make a War on that side, and to enlarge his Conquests as far as *Vienna*, no conjuncture having been ever so favourable to consummate such a design, in which *Solyman* so unhappily miscarried. They promised him an easie Victory, assuring him, that the Animosities of the Princes of the Empire were so heightned, that there was no room left for a Reconciliation, that he was but to go in the head of an Army to take possession, and that *Austria* would surrender at the first news of his march towards it. The Emperor was not to be moved at that time by these insinuations and plausible discourses; being continually urged, he as often denied. One day when they came to renew their advice about the *German War*, he having given order before, that several dogs should be kept for some days without meat, commanded that they should be brought out, being almost starved, and meat thrown among them; whereupon they snarled and bit one another: in the midst of their noise and fighting, he caused a Bear to be let loose in the same Area; the Dogs forgetting their meat, and leaving off their fighting, ran all upon the Bear, ready to prey upon them singly and at last killed him. This Diversion the Emperor gave his Bassa's, and left them to make the application.

A certain Prophecy of no small Authority runs in the minds of all the People, and has gain'd great credit and belief among them, that their Empire shall be ruined by a Northern Nation, which has white and yellowish Hair. The interpretation is as various as their Fausy. Some fix this Character on the

the *Muscovites* : and the poor *Greeks* flatter themselves with foolish hopes, that they are to be their Deliverers, and to rescue them from their slavery, chiefly because they are of their Communion, and owe their Conversion to the *Christian* Faith to the Piety and Zeal of the *Grecian* Bishops formerly. Others look upon the *Sweeds*, as the persons describ'd in the Prophecy, whom they are most to fear. The Ground and Original of this fancy I suppose is owing to the great Opinion, which they have of the Valour and Courage of that warlike Nation. The great Victories of the *Sweeds* in *Germany* under *Gustavus Adolphus* were loudly proclaimed at *Constantinople*, as if there were no withstanding the shock and fury of their Arms : and their continued successes confirmed the *Turks* in their first belief, and their fears and their jealousies were augmented afterwards, when *Charles Gustave*, a Prince of as heroick a Courage, and as great Abilities in the Art and Management of War as the justly admired *Gustavus*, entred *Poland* with his Army, and carried all before him, seized upon *Warsaw* and drove *Casimir* out of his Kingdom, and had almost made an entire and absolute Conquest, only a few places holding out. This alarmed the Grand Signor and the Bassa's of the *Port*, as if the Prophecy were then about to be fulfilled, who did not Care for the company of such troublesome Neighbours, who might push on their Victories, and joyning with the *Cossacks*, advance their Arms further, and make their Country the seat of a War, which might draw after it fatal consequences. To prevent which, Couriers are dispatch'd from *Constantinople* to *Ragotski*, Prince of *Transylvania*, then in concert with the *Sweeds*, to command him to retire with his Army out of *Poland*, as he valued the peace and safety of his own Country, and the friendship of the Grand Signor, whose Tributary he was, and by whose favour he had gain'd that Principality : And the *Crim-Tartars*, the sworn Enemies of the Poles, who at that time lay heavy upon them, were wrought upon by the same Motives and Reasons of State, to clap up a peace with them, that being freed from these distractions, they might unite their Forces the better together, and make head against the *Sweeds*.

The Ambassadors of *Christian* Princes, when they are admitted by the Grand Signor to an Audience, (their presents being then of course made, which are look'd upon as due, not to say, as an homage) are dismiss'd in few words, and referred

ferred by him to his *Wakil* or Deputy, as He usually stiles the chief *Vizir* : and a small number of their Retinue only permitted the honour of kissing his Vest, and then rudely enough sent away.

The Grand Signors keep up the state of the old *Asiatick* Princes : they do not expose themselves often to the view of the people, unless when they ride in Triumph, or upon some such solemn Occasion ; when they go to the Moschs, or divert themselves in the Fields, either in Riding or Hunting, they do not love to be stared upon, or approached. It is highly criminal to pry into their Sports, such an insolent curiosity being often punished with death. The Story is famous of *Morad* the Third, who baiting a Bear in the old Palace with a Mastiff, and espying three fellows upon the Tower of *Bajazids* Mosch, who had planted themselves to see the Sport, commanded their Heads to be struck off immediately, and be brought before him, which was done accordingly. Instances of such Capricio's are frequent in the *Turkish* History ; this following hapned during my stay at *Constantinople*.

Upon the return of *Vizir Achmet* from *Candia*, after the Surrendry of that City, and a happy end put by him to that tedious and bloody War, he acquainting the present Emperor, then at *Adrianople*, with the History of that famous Siege at large, made such terrible Representations of their and the *Venerians* mining and countermining one another, that the Emperor was resolved out of curiosity to see the Experiment made of a thing, that seemed to him almost incredible. A Work was soon raised and undermined, and above thirty Murderers and Robbers upon the high-way and such like Villains were put into it, as it were to defend it. The Grand Signor stood upon an Eminence at some considerable distance, expecting the issue of it ; upon a signal given, the Mine was sprung, and the Fort Demolished, and the poor wretches torn piece-meal to His great satisfaction and amazement.

The Moon is the auspicious Planet of the *Turks* : according to the course of which they celebrate their Festivals. They begin their Months from the first appearance of it, at which time they choose, except a delay brings a great prejudice and inconvenience with it, to begin their great Actions. The Crescent is the Ensign of the Empire

pire, which they paint in their Banners, and place upon the Spires of their Moschs. Next to the day of the appearing Moon, they pitch upon Friday, to fight upon, to begin a Journey, and especially their Pilgrimage toward *Mecca*, or do any thing of great Consequence, as very lucky and fortunate.

A Let

A Letter in answer to another of Mr. Hen. Oldenburgh's, wherein he desired an Explanation of a Paragraph, touching the use of the Intestinum Cæcum, publisht in the Philosoph. Transact. Num. 95. Anno 1673. which Paragraph is this.

The use of the Intestinum Cæcum, subservient to that of the Colon and Rectum; manifest in such Animals, where Nature intends a certain and determinate Figure to the Excrements.

Sir,

I did not think of Explaining my Sense of the use of the Cæcum until I had had the leisure and opportunity of purposely examining the Intestines of most kinds of Animals. But because I am much mistaken by the Person, who as you tell me, is desirous to be *anonymus* to me, him I mean who raised the Scruples you sent me, upon the second Paragraph, which says the use of the Intestinum Cæcum to be subservient, &c. I shall be forc'd to tell you, what I presume may prove as near the truth, as any one of the many Conjectures extant in Authors, about the unknown use of this Part.

I understand by determinate Figure. 1. The Excrements divided into many small parts of a like shape, such as Sheep, Deer, Conies, Hares, Rats, Mice, Horses Caterpillers, some Snails, &c. do naturally void. 2 In a greater latitude, I oppose figured Excrements to liquid, as C. Celsus in some place doth: Thus the Dung of Pigeons, Geese, and Men, Cats, Dogs, &c. may be said to be figured. Now the Cæcum in my Opinion is subservient in some measure to the figuration of both, but most manifest in the first kind. My meaning is, that probably the use of the Cæcum is to keep the Excrements, which shall pass into its Cavity (and I believe all, or most part of them do so in sound Animals) so long, until they are sufficiently drained, baked, hard'ned, or of a due consistence (as Clay is tempered for the mould) to receive the Figure to be given it from the Colon and Rectum. This use I say of the Cæcum, seems to me to be much more manifest in such Animals, as have figured Excrements of the first kind. In Rats for example, whose Excrements are constantly alike figured, the Cæcum is very large, more capacious than the Stomach it self. But its use in receiving the Excrements or exhausted Chyle, is not more apparent, from its large Capacity, than that other of farther drawing and tempering them to a stiffness, for the service of the Colon, from the admirable con-

trivance and structure of this latter Gut, which is a *Phænomenon* that deserves further Consideration: it is I say to be noted, that immediately under the valve of that Gut, in this Animal, are certain spiral Fibers, which make a kind of screw: now it seems to me, that the Excrements, after they are brought to a due Consistency by the necessary stay they make in the *Cæcum*, and being carried out thence into the spiral foldings, or screw of the *Colon*, cannot descend in a perpendicular, as formerly through the small Guts, but still gently glide, and that very leisurely by the winding of the screw; whence arises the Figure.

And I am apt to believe, that if the *Cæcum* of a Rat, or any of the first kind of Animals mentioned, was tyed up, or otherwise hindred from its receipt, the Animals would unavoidably fall into a *Diarrhæa*: there being I say no reason, that I can foresee, why the yet liquid Excrements or exhausted Chyle, such as we constantly find it, even at the very bottom of the small Gut, should stop at the entrance of the *Colon*, and not speedily glide through the screw, in a downright descent, that is, elude the devise of Nature. and make the configuration of that so curiously contrived part useless; we, I say, supposing the experiment to have taken away the necessary *Diverticulum* and Repository of the unprepared Excrements, in tying up the *Cæcum*.

I know not whether the Observation will hold good in general Terms, because I say I have not yet purposely examined divers Animals in Nature, *viz.* That where ever there are elegantly figur'd Excrements of the first kind, there is ever a capacious *Cæcum*; and on the contrary the less accurately figured and more liquid the Excrements of any Animals are, the lesser the *Cæcum*, or none at all. This is certainly true, that some Animals, which are naturally loose, have no *Cæcum* at all, or very little as the *Talpa*, the *Echinus terrestris*, the *Gulo*, and amongst Birds the Wood-pecker kind, the Hawke kind, &c.

We shall not trouble you at present with our observations concerning Figure of Excrements in the divers Species of Animals already by us examined; nor of the place of their being so figured. Also we shall pass by at present our thoughts of the manner of the *Cæcum's* reception, and preparing the Excrements for the *Colon*.

We likewise forbear to offer some doubts we have, concerning Nature's end, in the necessary Figuration of the Excrements.

crements in some Animals, as first to prevent Diarrhæa's; secondly to abide Hunger the better; Thus snails in the Winter rest with full Intestines: Thirdly and chiefly to heighten the fermentation and digestion, (of which I shall shortly publish my thoughts in another Tract) in the Stomach and small Guts. Also in like manner, why to some Animals liquidity of Excrements is as necessary.

What we have hastily writ at present, being only intended, for the better understanding that Paragraph, and not all, that this Subject would incite me to say, &c.

Thus far have I sent you of that Letter; the remainder I will shew you, when I shall see you here.

Westminster,
Nov. 6. 1683.

SIR,

Your most humble Servant,

M. Lyster.

The learned *Author* of the preceding *Discourse* visiting the *Bath* the last Summer, Anno 1683. exactly designed the *Roman Inscriptions* prefixt to this *Transact*, according to the *Originals* now to be seen at *Bath* in *Somersetshire*, formerly published in *Camden*, and since by *Guidot*, which he did to shew how unlike the *Originals* are, to the *Letters* of the *Press*; and that therefore to represent them well and faithfully, they ought first to be carefully designed and then Engraved. Which is here faithfully done.

The *Letters* of Fig. 2, 3, 4. are graven larger than the rest, because they are five Inches complete. Fig. the 8th. contains the *Inscription* of an *Altar* found near the *Roman Camp*, which is placed within the *Angle*, where the two *Rivers*, *Medloe* and *Erwin* meet, a little mile South-west of *Manchester* in *Lancashire*, and preserved in the *Garden* of the worshipfull *Edward Moseley de Holme Armiger*, where the same worthy Person saw it, and read it.

*Directions for the use of the following Tid Table, sent by
J. F. M. R. & R. S. S. to the Publisher*

SIR,

HAVING found my last years Tide Table very agreeable to Experience. I here present you with another for the year ensuing made by the same Theory and Numbers, but in a more convenient form for your Tracts. I must only desire those that use it, to note.

That when by reason of long droughts in Summer, or continual hard frosts in Winter, the fresh Waters are low, as also when the winds blow hard at N. or N. W. the Tides may hold up longer than the times shew'd in the Table.

But when the contrary winds blow hard, or by reason of great rains the Freshes are increased, they hold not out so long: yet have I very rarely found the difference more than half an hour.

I find by enquiry made amongst our most experienced Seamen, that the high Waters of our English and Neighbour Ports keep a good correspondence with these of the River of Thames; Having therefore instructed my self the best I could by conference with them, I have made the following Table of Reduction, whereby the Tide Table may be made to serve at the places underwritten, by Adding,

	<i>b. m.</i>
For <i>Timmouth-haven, Hartlepool, and Amsterdam.</i>	0 30
Brest	1 00
Sylly	1 45
Bridlington-Peer and Humber	2 00
Pensans, Weymouth, Hamburgh, and Hull	3 30
Lanon and Foulness	4 10
Bridgewater, Landsend and Texel	4 45
Portland, Hareflew, and without the Olie	5 40
And Subtracting.	<i>b. m.</i>
For <i>Leith, Maes, and Gouries Gut</i>	0 15
Gravesend, Rochester and Rammikins	1 00
Buoy of the Nore, and Flushingbead	1 20
Shoeb Beacon, Redsand, Portsmouth, Ostend	2 30
Spithead, Harwich, Dover, Calice, and Dublin	3 00
Orfordness, Gunfleet, Hastings, Shoreham, and Diep	4 00
Needles, and Yarmouth Peer	4 40
St. Hellens and Harverdegrace	5 30

The Table is Printed in a single half sheet by it self for the use of those that desire to have it alone, and is to be sold by Mr. Baker at the Sign of the Three Pigeons in St. Paul's Church-yard, London.

A Cor-

A Correct TIDE TABLE, Shewing the true times of the High-Waters at *London Bridge* to every day in the Year, 1684. By *J. F. M. R. & R. S. S.*

D	January.				February.				March.			
	Morning.		Afternoon.		Morning.		Afternoon.		Morning.		Afternoon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	8	53	9	29	10	46	11	22	10	30	11	04
2	10	03	10	38	11	55			11	37		
3	11	14	11	49	0	27	0	57	0	08	0	36
4			0	24	1	24	1	48	1	02	1	26
5	0	55	1	25	2	11	2	31	1	47	2	08
6	1	51	2	14	2	49	3	06	2	26	2	42
7	2	36	2	57	3	21	3	34	2	58	3	13
8	3	14	3	33	3	48	4	02	3	26	3	40
9	3	46	4	01	4	16	4	30	3	53	4	08
10	4	16	4	31	4	44	5	00	4	22	4	38
11	4	46	5	01	5	17	5	35	4	54	5	12
12	5	18	5	30	5	55	6	18	5	33	5	54
13	5	54	6	14	6	42	7	10	6	19	6	47
14	6	35	6	59	7	38	8	09	7	18	7	50
15	7	23	7	50	8	43	9	18	8	25	9	02
16	8	20	8	51	9	56	10	34	9	39	10	17
17	9	22	9	54	11	11	11	48	10	54	11	31
18	10	29	11	03			0	24			0	05
19	11	40			0	57	1	27	0	40	1	10
20	0	14	0	48	1	55	2	20	1	38	2	04
21	1	19	1	47	2	42	3	03	2	27	2	49
22	2	14	2	37	3	22	3	40	3	09	3	28
23	3	00	3	19	3	57	4	15	3	46	4	04
24	3	38	3	54	4	34	4	53	4	23	4	43
25	4	13	4	31	5	14	5	38	5	05	5	28
26	4	48	5	09	6	04	6	31	5	54	6	22
27	5	31	5	54	7	02	7	33	6	53	7	24
28	6	20	6	47	8	08	8	43	7	58	8	33
29	7	16	7	47	9	19	9	55	9	05	9	39
30	8	23	8	57					10	11	10	43
31	9	33	10	10					11	14	11	42

April.

D.	April.				May.				June.			
	Morning.		Afternoon.		Morning.		Afternoon.		Morning.		Afternoon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1			0	09		0	19	0	44	1		09
2	0	33	0	58	0	43	1	06	1	34	1	58
3	1	21	1	42	1	28	1	48	2	20	2	41
4	2	01	2	18	2	09	2	27	3	01	3	20
5	2	35	2	52	2	45	3	03	3	33	3	55
6	3	07	3	21	3	20	3	36	4	13	4	32
7	3	36	3	51	3	52	4	10	4	50	5	11
8	4	07	4	23	4	27	4	46	5	30	5	57
9	4	40	4	58	5	07	5	31	6	22	6	50
10	5	19	5	42	5	54	6	21	7	19	7	48
11	6	08	6	36	6	49	7	19	8	19	8	53
12	7	06	7	38	7	50	8	23	9	27	10	00
13	8	11	8	47	8	57	9	30	10	35	11	11
14	9	23	9	59	10	06	10	39	11	47		
15	10	35	11	11	11	14	11	47	0	21	0	54
16	11	45				0	20		1	24	1	52
17	0	18	0	48	0	51	1	21	2	19	2	43
18	1	17	1	44	1	48	2	14	3	04	3	23
19	2	10	2	34	2	39	3	01	3	42	4	00
20	2	56	3	16	3	21	3	41	4	17	4	34
21	3	35	3	54	4	00	4	19	4	52	5	10
22	4	14	4	33	4	39	4	59	5	31	5	49
23	4	54	5	18	5	22	5	42	6	10	6	31
24	5	43	6	10	6	07	6	32	6	54	7	18
25	6	38	7	07	6	57	7	22	7	42	8	07
26	7	36	8	07	7	49	8	16	8	34	9	00
27	8	36	9	07	8	43	9	11	9	28	9	58
28	9	36	10	06	9	39	10	07	10	29	11	00
29	10	34	11	02	10	35	11	02	11	30		
30	11	28	11	54	11	28	11	5	0	01	0	30
31						0	20					

July.

July.

August.

September.

July.					August.					September.				
D.	Morning.		Afternoon.		D.	Morning.		Afternoon.		D.	Morning.		Afternoon.	
	H.	M.	H.	M.		H.	M.	H.	M.		H.	M.	H.	M.
1	1	01	1	29	2	26	2	47	3	30	3	48		
2	1	56	2	20	3	07	3	25	4	05	4	23		
3	2	42	3	03	3	04	4	00	4	42	5	03		
4	3	22	3	40	4	17	4	35	5	26	5	51		
5	3	58	4	15	4	53	5	13	6	19	6	49		
6	4	33	4	51	5	35	5	59	7	21	7	56		
7	5	12	5	34	6	25	6	55	8	33	9	11		
8	5	56	6	20	7	26	8	00	9	48	10	23		
9	6	47	7	15	8	36	9	14	11	00	11	33		
10	7	45	8	18	9	51	10	30		0	05			
11	8	52	9	27	11	07	11	43	0	34	1	01		
12	10	04	10	42			18		1	25	1	46		
13	11	19			0	49	1	18	2	07	2	26		
14	0	06	0	31	1	43	2	07	2	43	2	58		
15	1	04	1	34	2	27	2	46	3	12	3	26		
16	2	01	2	24	3	03	3	18	3	40	3	54		
17	2	45	3	04	3	33	3	47	4	08	4	23		
18	2	22	3	39	4	00	4	14	4	39	4	54		
19	3	54	4	10	4	28	4	42	5	13	5	34		
20	4	25	4	39	4	58	5	15	5	55	6	20		
21	4	54	5	11	5	34	5	53	6	47	7	16		
22	5	29	5	46	6	16	6	40	7	48	8	23		
23	6	07	6	28	7	08	7	35	8	59	9	35		
24	6	50	7	14	8	07	8	40	10	11	10	47		
25	7	40	8	09	9	16	9	53	11	23	11	57		
26	8	39	9	11	10	30	11	06		0	30			
27	9	43	10	17	11	42			1	00	1	27		
28	10	50	11	27	0	17	0	49	1	53	2	16		
29			0	01	1	18	1	45	2	39	2	59		
30	0	34	1	06	2	10	2	33	3	19	3	37		
31	1	35	2	02	2	54	3	12						

October.

D.	October.				November.				Decembrr.			
	Morning.		Afternoon		Morning.		Afternoon.		Morning.		Afternoon.	
	H	M	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	3	55	4	14	5	09	5	39	5	30	5	53
2	4	35	4	56	6	01	6	28	6	17	6	41
3	5	20	5	49	6	58	7	28	7	07	7	32
4	6	15	6	46	7	57	8	29	7	57	8	24
5	7	01	7	51	8	59	9	29	8	50	9	17
6	8	26	9	01	9	57	10	24	9	44	10	12
7	9	35	10	08	10	53	11	20	10	01	11	06
8	10	40	11	11	11	45			11	33		
9	11	40			0	01	0	33	0	01	0	27
10	0	07	0	33	0	58	1	20	0	53	1	19
11	0	57	1	19	1	41	2	02	1	43	2	06
12	1	39	1	59	2	22	2	40	2	27	2	47
13	2	16	2	33	2	57	3	13	3	06	3	23
14	2	49	3	05	3	29	3	46	3	01	3	57
15	3	20	3	35	4	03	4	19	4	14	4	32
16	3	50	4	05	4	38	4	56	4	50	5	10
17	4	21	4	38	5	18	5	40	5	31	5	53
18	4	56	5	16	6	05	6	30	6	17	6	42
19	5	38	6	03	6	58	7	26	7	09	7	36
20	6	29	6	58	7	56	8	27	8	07	8	39
21	7	30	8	01	8	59	9	32	9	01	9	47
22	8	35	9	10	10	06	10	39	10	23	11	01
23	9	45	10	20	11	14	11	48	11	37		
24	10	53	11	27			0	21	0	14	0	49
25			0	00	0	53	1	23	1	21	1	51
26	0	30	1	00	1	52	2	19	2	19	2	44
27	1	28	1	54	2	43	3	06	3	06	3	25
28	2	18	2	42	3	26	3	47	3	44	4	01
29	3	04	3	24	4	07	4	27	4	17	4	35
30	3	44	4	04	4	47	5	08	4	52	5	10
31	4	25	4	46					5	29	5	47

*A Letter concerning some form'd Stones found at Hunton in Kent,
from Griff. Hatley, M. D. of Maidstone in Kent.*

SIR,

ALTHOUGH I fear the Doctrine of petrification will receive but little light from this Account, yet since you may deduce more from it, than I foresee, I have at your Request sent it to you.

My Brother at the opening of a piece of Ground, at his house in *Hunton*, (five miles from this place, and about a quarter of a mile from the River *Medway*. 1. After the coping was taken off (which was a Clay about three foot deep,) He came to a very good blew Marle, which continued such three feet and $\frac{1}{2}$ deep more, and then there appeared a hard floor or pavement composed of Shells, or shell-like stones, crowded closely together; the interstices whereof were filled up with the same Marle. This layer (which runs as the veins of Flints do in chalky Earth) was about an inch deep, and several yards over, and we could walk on it, as on a Beach. Under this layer we came to Marle again; but the depth I do not well remember, I think it was a foot: this ground hath a pond on one side of it, which probably was heretofore a marl pit, and it is almost surrounded with Springs, which first encouraged my Brother to the opening it, his design being to enlarge the Pond. I cannot upon enquiry find that in the memory of any man thereabouts, any floods from the River have reached so far as this place.

These Stones (for I take them to be *lapides sui Generis*) are of that sort which is called *Conchites*; and resemble Sea-fish of the testaceous kind. Most of them are turbinated, or wreathed, the rest are of the bivalvular sort, but I have not found any of them with valves closed together, but single.

The bigness of the turbinated, is from a Vetch, to a Hassell-Nut, they are all filled with a *Terra lapidea*, like the Marl, and are of that colour, till you have washed, and rubbed them, and then they appear of the colour of Bezoar, and of the same politure. After they have been boiled in water, they are whitish, and leave a chalkiness upon your fingers, which when it is rubbed off, gives you a view of very fine black *striae*, thick set on the outside. These wreath'd

stones are all perfectly formed; they differ not in figure one from another, but that some have their sides a little depressed: upon a few of them there adhered a little portion of a glittering mineral like Iron, which Mr. Lister hath often observed, *item conchites plurium generum, atq; multa fossilia pyrite infecta, de Font. Med. cap. 2. p. 30.* I put some of them into Vinegar where they made a strong and a boiling effervescence.

The Bivalvular are most of them no bigger than a kidney Bean, some lesser, a few as broad as the largest sort of Beans, but the valve much thinner than any of that kind, which had been the *Exuvie* of an Animal, the gibbous part of the valve is smooth, and of the same colour with that of the turbinated. In a few there are some oblong lineations bent circularly to the commissure of the valve: I have a piece of such a one by me consisting of several *Lamella*, which hath this further observable in it, that the gibbous part is of a most beautiful black shining colour, and the inner part of a shining pearl colour'd substance.

Of this bivalvular sort many of them seem to be *in feri*, not as to their shape but as to their hardness and thickness, there being in some only the *prima stamina*, and in others, the several steps and progresses toward a perfect Figuration, which seems to me an unanswerable Argument, for their never having been the spoils of Animals. Some of these appeared in the inner side white, and it came off upon the fingers like Chalk, and seemed as if a depression had been first made in the bed, of the shape of a valve, and then the convex side rubbed with Chalk or painted white.

Those pieces of this odd concretion which I keep by me (now the Marl, which is in the interstices, is grown hard) appear much like that coarse sort of Marble-stone which is dug about *Pluckley* in the Wild of *Kent*. Which Marble seems to be a coagmentation of such shell-like stones, the Marl betwixt them having acquired a firm solidity and hardness. With this stone they make their Causeys in that part of the County: and they are apt to be worn into little cavities, or holes, where they have lain long exposed to the Air; the rains in length of time washing away the portions of Marl (which is less hard than the rest) from the orifices and interstices of those shell-like stones. I am much confirmed in this Opinion by a piece of Marble, inlaid as it were with such

such stones which was dug out of a Marl-pit, at a little distance from, and on the same level with that of my Brothers, it is now converted into the leaf of a Table, and in the possession of the worshipful *Thomas Fane* Esquire, in whose grounds it was dug. I think it might not be a very different sort of stone which the Learned Mr. *Lister* mentions in the forecited Book, cap. 2. pag. 20. *huic autem lapidi soliditas marmorea est, & quæ poliri possit; maximeq; si cochlites aliquis eo misceatur, a nostris ad polituram valde expetitur.*

The imperfect as well as the complete formation of some of the bivalvular kind (the valves being only found single, and both sorts in a ground never heretofore disturbed) are no light arguments for their being stones. But by what means they receive this likeness to shells, is hard to determine, your own conjecture satisfies me best. *mus. reg. societ. part. 3. cap. 1.* and there can be no convincing argument given, why the salts of Plants, or animal Bodies, washed down with rains, and lodged under ground; should not there be disposed into such like Figures, as well as above it: probably in some cases much better, as in a colder place; and where therefore, the work not being done in an hurry, but more slowly, may be so much the more regular.

My Brother purposes to dig up much more of the same ground the next Summer: if any thing then occur, that may be added to this, or may afford reason why I should alter my Opinion, about their being stones, I shall acquaint you with it, for whatever aversion I have to say any thing of a subject of this nature, is all conquered by the great desire I have to express my self.

S I R,

Maidstone, Nov. 12. 1683.

Your most

Humble Servant,

Griff. Hatley.

RAPHAELIS FABRETTI *Urbinitis de Aquis & Aquæductibus veteris Romæ Dissertationes tres in Quarto Romæ, 1680.*

1. **T**He first Discourse of the noble and ingenious *Fabretti* represents the Art and Grandure of the *Aquæductus Alexandrinus*, which taking name from *Severus* the Emperor, as *Spartianus* assures, runs obliquely for a good Foundation, yet loftily, in most places upon an Arc LXX. foot high, through *Procoio di Pantano* between the *Via Labicana* and *Prænestina*, hard by the noble Sepulcher of the said Emperor and his Mother, unto the Vineyard of the *Carthusians* in the City, at 14 miles distance from its Fountain. The Duct or *Specus* is $2\frac{1}{2}$ foot broad, $4\frac{1}{2}$ high, and thick in the sides $2\frac{1}{4}$, admitting in divers places an Aperture or Breath-hole made of *Tophus* $2\frac{1}{2}$ foot square: and is sustein'd by square Piles of Brick, 8 foot thick, well cemented and inwardly polisht; and cover'd with an Arc of the same matter 12 foot over.

2 The second Dissertation, which treats of *Aqua Marcia* and *Claudia*, is opportunely prefac't with the measure of the Old Roman Foot: which this Learned Italian asserts to be the *Pes Capitolinus*, that *L. Pætus* procur'd, more than an hundred years since, to be exprest on a marble Table in the Capitol, together with the Roman Palm of nine inches, and the *Canna Architectonica* of ten Palms, and the *Decempeda* or Rod of ten Foot. Our Author comparing the two last together, found the Modern or Architectonic Palm to make near $9\frac{1}{11}$ inches of the Ancient Roman Foot, the *Canna Architectonica* reaching to $7\frac{3}{4}$ Foot of the old *Decempeda*: and consequently that a Roman Mile, or 5000 Foot, contains near 660 $\frac{1}{5}$ of the modern *Cannæ*; not 667 *Cannæ*, as *L. Holstenius* estimates in his Discourse *De miliaribus Aureo*, mistaking the modern Roman Palm for just $\frac{3}{4}$ of the Antique Roman Foot. Much less will 650. *Cannæ* of the Later Surveyors extend to the length of an old Roman mile, as *L. Pætus* computed. But the measure of the *Pes Capitolinus* on the marble Table foremention'd, (and not the Print of it p. 88 *L. Pæti de mensuris*, too scanty by $\frac{3}{4}$ of an inch,) is sufficiently confirmed by three joyned Brass-Feet found in different places, and by several Bricks, carrying one Foot in length, and an half in bredth, taken up from the Ruins in *Via Ostiensi* and in divers other places.

Where-

Wherefore this *Capitol Foot* ought to be preferred unto the rude Draughts on the Monuments of the ancient Architects, *M. Abutius*, *T. Statilius*, and *Un. Cossutius*; which last is taken for the very Roman Foot by the honor of our Nation *Dr. John Greaves*. Yet this, as well as the *Statilian*, falls short of the *Capitol-Foot* by near $\frac{1}{8}$ part of an inch, whereas the *Abutian* is about as much too large. Moreover the *Villalpandine Module*, argued loosely and inversly from the Content of the *Vestasian-Congius*, exceeds by $\frac{1}{5}$ of an Inch the *Capitoline* or *True Roman Foot*: for to this do precisely agree, says our wise and experienced Author, the numerous Patterns and Remains of ancient Architecture, that are daily dug up about the City. Soon after he gives a public Example of the *Capitoline Foot*, telling us it futes exactly with the 73. of those cxxv. spaces into which *Villalpandus* divides his *Semicircular Instrument* p. 3: 6. *Comment in Ezech.* Lastly, the Foot which *Ricciolus* offers us for *Roman* in his *Almagest*. p. 58. surpasseth the *Capitoline* by a full Digit, or $\frac{1}{16}$ of the whole: and his other measure *Geograph. Reform. f. 34.* by $\frac{1}{18}$ part. But to return to our *Aqueduct*, highly extoll'd by *Pliny*, *Plutarch*, *Arrian*, *Frontinus*, and in this Clause of *Propertius*, *Avernum Marcius humor opus*. This *Water* taking its name from King *Ancus*, and as deservedly from *Publius* and *Quintus*, in the same *Marcian Family*, οἱ πλείους ὕδαρ καὶ ῥέανισον ἐν Ρώμῃ καὶ παλαιότες, &c. ariseth not from the *Lacus Fucinus* (whence *Pliny* and *Statius* would fetch it) but in the *Cross-path* between the *Via Valeria* and *Sublacensis*, two miles short of *Cæculus* and *Curtius*, the Fountains of *Aqua Claudia*: but observes the same Level with the *Claudian*; because it descends more precipitate from the Origine. Yet within 5 miles of *Rome* the *Aqua Marcia* runs 20 Foot lower than the *Aqua Claudia*. But at 7 miles distance from *Rome*, and at a mile and an half from the midway to *Marino*, as *Fabretti* after *Frontinus* exactly measur'd, the *Aqua Marcia* is both purified and moduled, by falling into, and soon after rising up from a long square *Piscina* or *Cistern*, 6 foot deep, made of Flint, and cover'd with a Net work, by order of *Hadrian* the Emperor. Now the latter use of these Ponds or Cesterns, that sufflamine the Current of the *Aqueducts*, is frequently taken notice of by *Frontinus*: so that Signior *Castelli* his belov'd Probleme, *Ex velocitate aqua modum ejus variare*, is not so new as he pretends.

3. The third Dissertation concerning *Aqueducts*, the best Argument, by the confession of *Dionysius*, *Strabo*, *Pliny* and others, of the Magnificence of *Rome*, remarques that of the fourteen *Aqueducts* which *Procopius* found at the City in his time, ten are now quite lost ; and the other four, namely *Aqua Crabra* or *Dammata*, *Trajana*, *Alexandrina*, and *Virgo* much corrupted. The last so much fam'd in Antiquity, arising near *Rivus Herculaneus*, is derived unto *Porta Flaminia* at the length of *LXIII. Acres* or *3024. Roman Paces*. For to the *Ports* of *Rome*, and not (as the Incomparable *Holstenius* contends) from the gilded *Miliarium*, the conducts of *Ways* and *Waters* are precisely to be estimated. Upon this occasion Signior *Fabretti* ingeniously acknowledges, against t^e Exorbitance of *J. Lysius* and others, that the compass of *Rome* (*ambitus Urbis*) by its Ancient *Ports*, should be reduc't in *Plinies* numbers from *XIII.* by an easie change unto *VIII Miles* ; to accord to the the magnitude of *Athens*, which is the Assertion of *Strabo* : as also to the limits of *Dionysius*, within the ridge of the *Hills*, the *Tumuli*, the *Tibur*, and the *Agger*. Yet (*Rom. amplitudo*) *Rome* taken with all its *Suburbs*, according to the same *Pliny* and to this *Dissertator*, made a wide Circuit of *LXX. Miles*. This in brief from the three Learned Discourses of Signior *Raphael Fabretti*.

ERRATA.

PAge 399 l. 14. p. 404 l. 2. p. 413. l. 1. for *Saturn* r. *Jupiter*. pag. 409. l. 24. after the Earth, *insert*, where this Ecclipsē is f. en. p. 411. l. 2. for opposition of the Ingresses, r. Opposition, the Ingresses, p. 424. l. 9. Orbitæ. p. 442. l. 18. for in, r. to. p. 446. l. 38. r. their having.

OXFORD,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*,
at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in St.
Paul's Church-yard LONDON. 1684.

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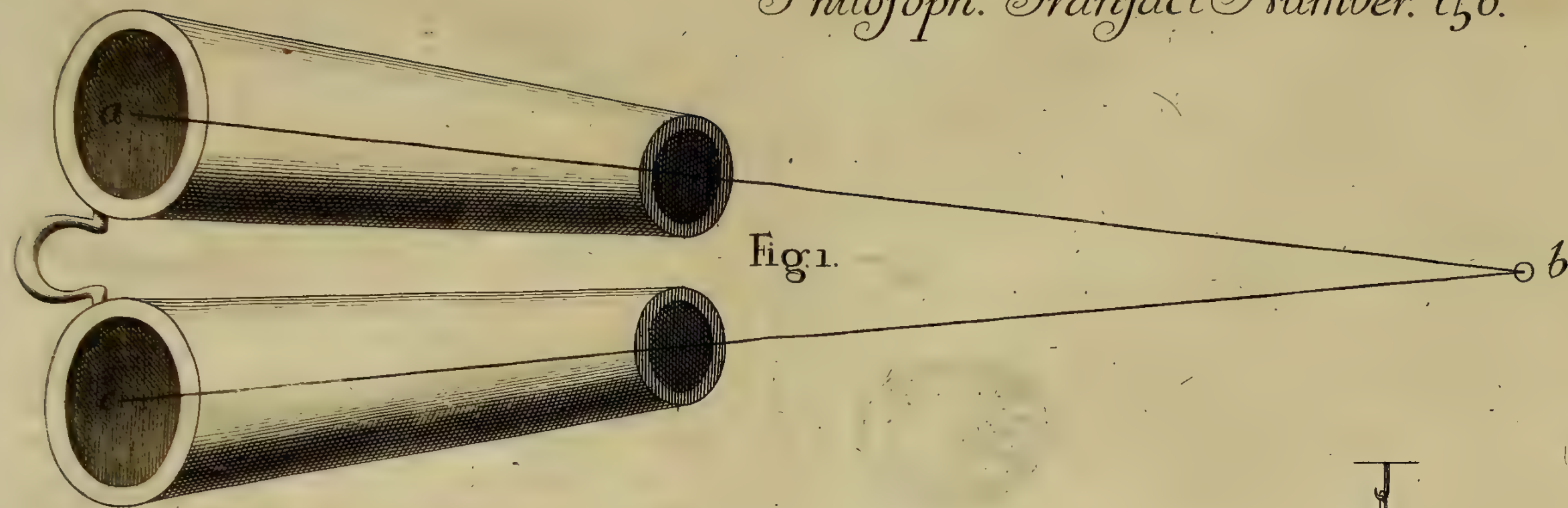


Fig. 2.

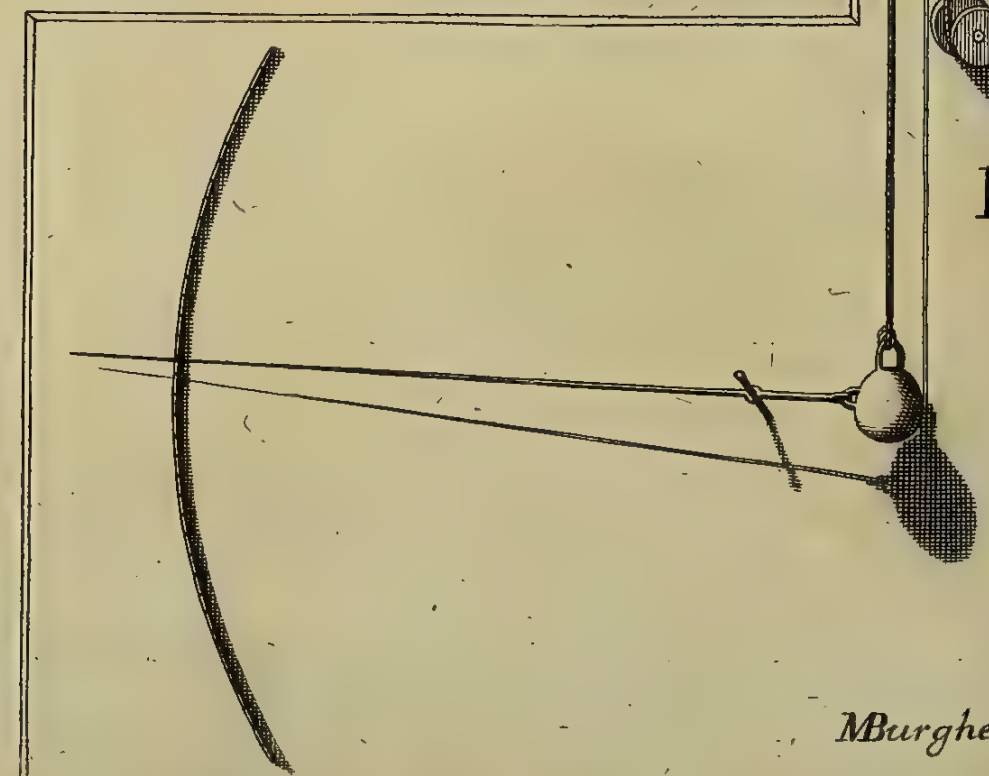
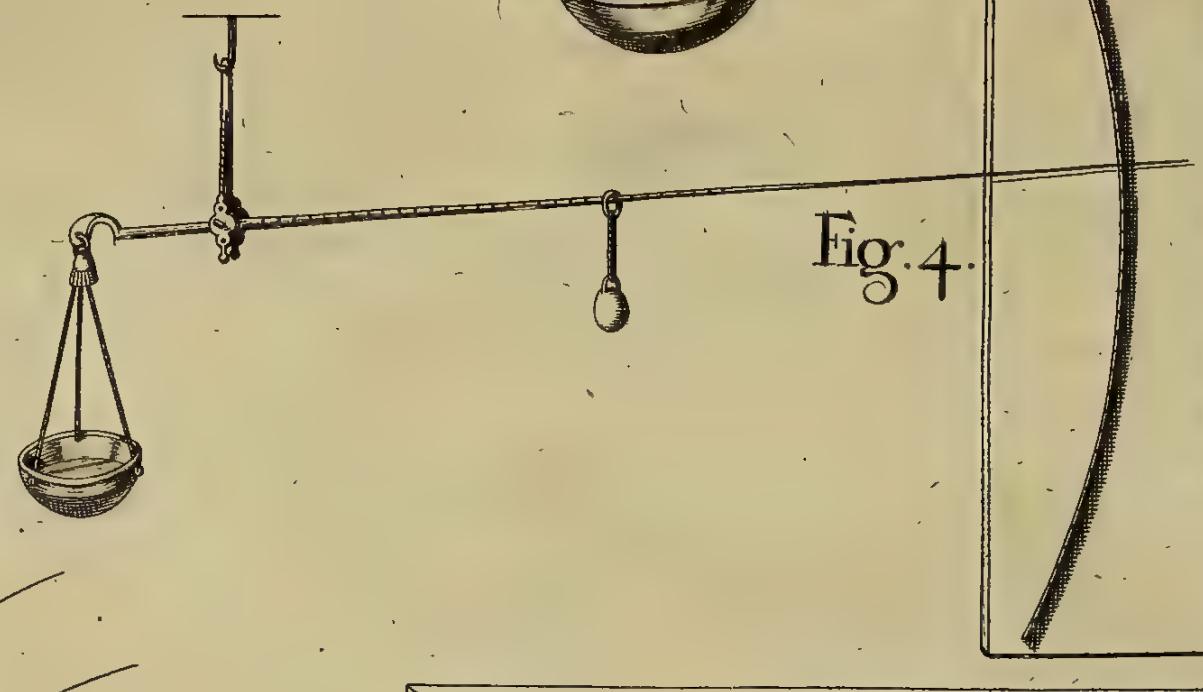
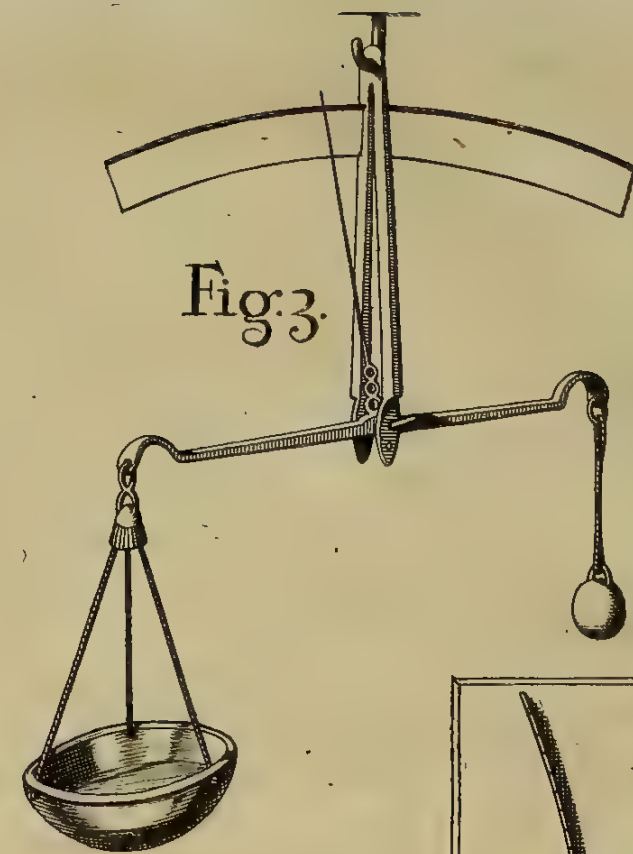


Fig. 5.

PHILOSOPHICAL

TRANSACTIONS.

Feb. 20. 1683.

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2. *Certain observations of the Midland Salt-Springs, in Worcester-shire, Stafford-shire and Cheshire. Of the crude Salt which grows from the Stone-powder dejected by the said Brines in Boiling. Of the specific difference betwixt Sea-salt and Common-salt. A way (which seems to be the true Method of Nature) of distilling Sweet and Fresh-water from Sea-water, by the breath of Sea-plants growing in it. That this breath probably is the material cause of the Trade or Tropic-winds. By the learned Martin Lister Dr. of Physick of the University of Oxon.*
3. *An Account of the increase of weight in Oyl of Vitriol exposed to the Air. In a Letter to the Publisher from William Gould M. B. and Fellow of Wadham Colledge Oxon. An account of a book intituled Ricreatione Dell' occhio è della mente nell' Osservation' delle Chiocciolè, &c. Dal P. FILIPPO BUONANNI in Roma per il Varesè. 1681. in Quarto.*

For the Author's Name see the An

An introductory Essay to the doctrine of Sounds, containing some proposals for the improvement of Acousticks; As it was presented to the Dublin Society Nov. 12. 1682. by the Right Reverend Father in God Narcissus Lord Bishop of Ferns and Leighlin.

BEing to treat of the Doctrine of *Sounds*, I hold it convenient to premise something in the general concerning this Theory; which may serve at once to engage your attention, and excuse my pains, when I shall have recommended them, as bestow'd on a subject not altogether useless and unfruitful.

And for this purpose I shall omit to speak any thing of the *Excellency* of the matter in hand; though it might be celebrated by Arguments drawn from several Topicks, and particularly from this, that new discoveries and improvements may be made, both as to the *Generation, Propagation* and *Reception* of Sounds into the Sense; which in a peculiar manner agrees to this, above the object of any other Sense whatsoever. I shall, I say, omit these things, and apply my self wholly to the *Usefulness* of the Theory, that we are now falling upon; which I think cannot better be discovered, than by making a comparison 'twixt the Senses of *Seeing* and *Hearing* as to their improvements. I mean, by shewing, that this later of *Hearing*, is capable of all those improvements which the Sense of *Seeing* has received from Art; besides many more advantages, that the *Ear* may enjoy, by the help of our Doctrine, above the *Eye*; all which moreover will be of as great benefit to mankind, as any thing that *Opticks* have yet discovered, if not of greater; which, with some other preeminencies that it has upon another Score, will happily render *Acousticks* the nobler Science of the two.

In order to the making good what I but now promised of the Comparison of these two Faculties of *Seeing* and *Hear-*

Hearing, as to their improvements, I observe,

That *Vision* is threefold, *Direct*, *Refracted*, and *Reflex'd*; answerable whereunto we have *Optick*, *Dioptricks*, and *Catoptricks*.

In like manner *Hearing* may be divided into *Direct*, *Refracted*, and *Reflex'd*; whereto answer three parts of our Doctrine of *Acousticks*; which are yet nameless, unless we call them *Acousticks*, *Diacousticks*, and *Catacousticks*, or (in another sence, but to as good purpose) *Phonicks*, *Diaphonicks*, and *Cataphonicks*.

1. *Direct Vision* has been improv'd two ways; *ex parte Objecti*, and *ex parte Organi vel Medij*.

1. *Ex parte Objecti* *Direct Vision* has receiv'd advantages by the Arts of *Producing*, *Conserving* and *Imitating Light* and *Colours*, which are the Objects of *Vision*.

1. For the Art of *Producing Light*, we have the *Frication* of all hard Bodies, that beget *Fire*; especially of the *Flint* and *Steel*; and instead of the *Flint*, most hard *Stones* (as well as the *Cane*) may be us'd to the same effect; as upon trial I have found. Add hereto the lately invented *Phosphorus*, which is a new and admirable way of producing a *Lucid substance* by Art, out of a body in it self not *Lucid*; and therefore may not unfitly be term'd an *Artificial production of Light*.

And then of the Art of *Conserving Light*, the *Lapis Bononiensis* is a notable instance; and so happily were the *Sepulchral Lamps* of the *Ancients*.

2. As to *Colours* 'tis the greatest part of the Art of *Dying* to be able to make and fix (that is preserve) them; and the *Painters* and *Limners* will own it to be no small part of their Skill to be able well to *Mix* (that is in effect, to *Generate*) *Colours*.

3. For *Imitation of Light* and *Colours* 'tis well known how far *Perspective* with the Art of *Limning* and *Shadowing*, have gone therein; which all tend someway to the *Advance or Improvement of Direct Vision*.

Add to all these, That a *due Application of Light to the Object* renders it Visible, if it were not so before ; as appears from a dark room illuminated : or else makes it better and more truly discernable by the Sense of *Seeing* ; if before it might have been discern'd.

Hence the same *Colour* in a divers *Light* will appear different, and no *Pictur*e can well be discern'd or judg'd of, but by it's true *Light*. Besides, the *Limn r* will assure you, that he can hardly make true work or hit the Air of a face exactly, unless he draw by a *North-Light*, by reason of the *Steddiness* of that, and the uncertainty of all other *Lights* whatsoever. Which things shew, that the *Art of duly applying Light to th Object* does very much help and improve *Vision*. So also does the due placing of the *Object*, as to *Height* and *Distance*. But to enumerate all things, that help *Direct Vision*, would be infinite.

2. *Ex parte Organi* v l M *dij* *Direct Vision* has been improved by making use of a *Tube*, without *Glasses*, or a mans clos'd hand, to look throw ; which admitting into the *Eye* only the principal raies, that come directly from the *Object*, do very much strengthen and clear the *Sight*, by excluding all the *Collateral raies*, that crouding into the *Eye*, together with the direct ones, would confound and disturb it, partly by mixing and interfering with the *Direct raies*, and partly (or rather chiefly) by too much enlightening the fund of the *Eye*, wherein *Vision* is truly (though then imperfectly) made.

On this is founded the *Art of making Spectacles* without *Glasses* ; (as well as *Tubes*) which is done by putting into the *Glass-holes* (instead of *Glasses*) two short *Tubes* of between 3 and 4 inches long (for their length is to be vary'd according to the age or eye of the beholder, and so also is the *Diameter* of the extream ends) which *Tubes* being made of *Spanish Leather* (or past-board, or some such like matter) and black'd on the inside, are so to be plac'd, as that the visual raies, receiv'd throw them may meet in
one

one point (or rather issue out from one point) of the Object standing at such a due distance, as the person may clearly and distinctly see it, or according to his length of Sight (as ABC, in the first Fig.)

And these *Spectacles* may be supposed better for preserving the Sight, then the ordinary ones with Glasses because they represent the Object more naturally, and withal more clearly and distinctly to the Eye, then the other, whose refracted raies being collected together with the right ones in the Glasses, do somewhat confound good Vision; as before. Especially if the visive power be strong enough to be sufficiently determin'd by the right raies alone.

For I speak now of preserving a good Eye by these Spectacles; which holds in proportion true also of a bad one. Because those Raies (both right and refracted) being collected and brought so near the Eye (whether good or bad) as the Spectacles are usually plac'd, do too much affect it, both by their own brightness, and also by the brightness of the colours of the Object (when they are bright) which is brought very near also; whereby the Eye is dazl'd and confounded; unless there be a strong attention and *conatus* of the Spirits, whereto the bright Raies do certainly engage them; which of necessity weakens Vision; especially if these Glass-spectacles be much us'd.

Wherefore the now describ'd new Tube-spectacles, contributing so much to the help and preservation of Sight; may well be counted an improvement of *Direct Vision*; because they convey the raies to the Eye without any kind of refraction whatsoever. Seeing the same Object also through various holes, plac'd at certain distances, does somewhat alter Vision; but of this perhaps more hereafter.

Now as *Direct Vision* has thus been improv'd; so likewise *Direct Hearing* partly has already receiv'd, and partly may (by the Doctrine whereof we are treating, if well cul-

cultivated) farther receive as great and notable Improvements, both *ex parte* Objecti, and *ex parte* Organi vel Medij.

1. As to the *Object* of hearing, which is Sound, improvement has been and may be made, both as to the *Begetting*, and as to the *Conveying* or *Propagating* (which is a kind of *Conserving*) of Sounds.

1. As to the *Begetting* of Sounds. The Art of Imitating any Sound, whether by *Speaking* (that is pronouncing) any kind of Language, (which really is an Art; and the *Art of speaking* perhaps one of the greatest) or by *whistling* or by *Singing* (which are allow'd Arts) or by *Hollowing* or *Luring*, (which the Huntsman and Faulkner would have to be an Art also) or by *Imitating* with the Mouth (or otherwise) the voice of any Animal; as of *Quails*, *Cats* and the like, or by *Representing* any Sound begotten by the Collision of Solid Bodies or after any other manner; these are all *Improvements* of *Direct Hearing*, and may be improv'd.

Moreover the skill to make all sorts of *Musical Instruments*, both Ancient and Modern, whether *Wind Instruments* or *String d*, or of any other sort, whereof there are very many (as *Drums*, *Bells*, the *Systrum* of the Egyptians, and the like) that beget (and not only propagate) Sounds; the skill of making these, I say, is an Art, that has as much improved *Direct Hearing*, as an Harmonious Sound exceeds a single and rude one, that is, an immusical *Tone*: which Art is yet capable of farther Improvement. And I do hope, that by the rules, which may happily be laid down, concerning the *Nature*, *Propagation* and *Proportion* or *Adapting* of Sounds, a way may be found out, both to improve *Musical Instruments* already in use, and to invent new ones, that shall be more sweet and luscious, then any yet known. Besides that by the same means *Instruments* may be made, that shall imitate any sound in Nature, that is not Articulate; be

it of Bird, Beast, or what thing else soever.

2. The *Conveying* and *Propagating* (which is a kind of *Conserving*) of Sounds, is much help'd by *duly placing the Sonorous Body*, and also by the *Medium*.

For if the *Medium* be *Thin* and *Quiescent*, and the *Sounding body plac'd conveniently*, the Sound will be easily and regularly propagated, and mightily conserv'd. I say,

1. If the *Medium* be *Thin* and *Quiescent*; because it otherwise caueth a *Refracted Sound*; of which afterwards. Hence in a *Still Evening* or the *dead of the night* (when the wind ceases) a Sound is better sent out and to a greater distance, then otherwise; though much of this may be ascrib'd to it's *Refraction* also.

2. I say, that the *Sonorous Body must be plac'd conveniently*, near a *Smooth wall*, near *Water*, or a *Plain*, whose surface is even.

1. Near a *Smooth wall*, either *Plane* or *Arch'd* (*Cycloidically* or *Elliptically*, rather then otherwise; though a *Circular* or any *Arch* will do; but not so well.)

Hence in a *Church*, the nearer the *Preacher* stands to the wall (and certainly tis much the best way to place *Pulpits* near the wall) the better is he heard, especially by those, who stand near the wall also, though at a greater distance from the *Pulpit*; those at the remotest end of the *Church*, by laying their *Ears* somewhat close to the wall, may hear him easier then those in the middle.

Hence also do arise *Whispering places*. For the voice being applied to one end of an *Arch*, easily rous to the other. And indeed were the *motion* and *propagation* of Sounds but rightly understood, 'twould be no hard matter to contrive *Whispering places* of infinite variety and use. And perhaps there could be no better or more pleasant hearing a *Consort of Musick*, then at such a place as this; where the Sounds rousing long together, before they come to the *Ear*, must needs consolidate and imbody into one; which becomes a true composition of Sounds, and is the very life and soul of *Consort*.

2. If the Sonorous body be plac'd near *Water* the sound will easily be convey'd, yet mollified; as experience teacheth us from a Ring of *Bells* near a river and a great *Gun* shot off at Sea; which differ much in the strength, and yet softness and continuance or propagation of their Sounds, from the same at land; where the Sound is more harsh and more perishing, or much sooner decays.

3. In a *plane* a Voice may be heard at a far greater distance, then in uneven ground.

The *Reason* of all which last nam'd *Phænomena* is the same, because the Sonorous air meeting with little or no resistance upon a *Plane* (much less upon an Arch'd) smooth superficies, easily rous along it, without being let or hindred in its Motion, and consequently without having its parts disfigur'd, and put into another kind of Revolution, then what they had at the first begetting of the Sound. Which is the true cause of its *Preservation* or *Progression*; and fails much when the air passes over an uneven surface, according to the degrees of its inequality. and somewhat also, when it passes over the plane superficies of a body, that is hard and resisting.

Wherefore the smooth top of the *Water* (by reason of its yielding to the Arch'd air, and gently rising again with a kind of resurge, like to *Elasticity*, though it be not so; by which resurge it quickens and hastens the motion of the air rouling over it, and by it's yielding preserves it in it's Arch'd Cycloidical or Eliptical Figure) the smooth top of the water, I say, for these reasons, and by these means, conveys a Sound more entire and to a greater distance, then the plane surface of a piece of ground, a wall, or any other Solid Body whatever can do.

As for the *Speaking Trumpet*, by which a voice may be conveyed to a considerable distance, I refer it's consideration to that of *Refracted Sounds* or *Refracted Audition*.

Thus much of the Improvements of Hearing, that respect it's *Object* which is *Sound*.

2. The

2. The *Organ* and *Medium* are to be consider'd. And,
 1. The *Organ*, which is the *Ear*, is helpt much by placing it near a *Wall* (especially at one end of an Arch, the Sound being begotten at the other) or near the Surface of *Water*, or of *the Earth*; along which the Sounds are most easily and naturally convey'd; as was before declar'd. And 'tis incredible, how far a sound made upon the Earth (by the trampling of a Troop of Horses, for Example) may be heard in a still night, if a man laies his Ear close to the ground in a large plane.

Otacousticks here come in for helping the *Ear*; which may be so contriv'd (by a right understanding the *Progression of Sounds*, which is the principal thing to be known for the due regulating all such kinds of Instruments) as that the Sound might enter the Ear without any Refraction; but as now they are generally made I refer them to *Refracted Audition*.

2. As to the *Medium*, I know not how that, by any contrivance of Art, can advantage *Direct Hearing*, otherwise then I have declar'd already in the propagation or conveyance of Sounds; though to the *Refracting or Reflecting* of them it may very much conduce; of which presently.

And so I have done with the first part of my present undertaking, which is the *Comparison of Direct Vision and Audition*, as to their Improvements from Art. The rest follow.

Wherefore,

II. Concerning *Refracted Vision* and it's Comparison, I observe, that *Refracted Vision* is always made *Ex parte Medij*; as *Reflected* is *ex parte Objecti*. And therefore though *Direct Vision* may be help'd *ex parte Objecti*, *Medij* vel *Organi*; yet *Refracted* can be improv'd only *ex parte Medij*, and *Reflected ex parte Corporis oppositi* alone. Unless it be in a mixt or compound Vision, that is *Refracto-Reflext*, when the reflext raies pass to the Eye through a refracting Medium, such as the *Medium Internum*,

contain'd in the body of the Eye, always is. So that in truth all Vision is *Refracted*, by an Internal Refraction made in *ipso Oculo*.

And all that I have spoken of *Vision* holds true of *Hearing* also, both *Refracted* and *Reflext*, and therefore need not be repeated.

Refracted Vision arises from the different *Density*, *Figure* and *Magnitude* of the Medium; which is somewhat alter'd also by the divers *Incidence* of the Visible raies. And so it is in *Refracted Hearing*, all these Causes concur to it's production, and some others to be hereafter consider'd.

Now as any Object (a man for example) seen through a thicken'd air, by *Refraction* appears greater then really he is : So likewise a *Sound*, heard through the same thicken'd part of the *Atmosphere*, will be considerably vary'd from what it would seem to be, if heard through a thinner Medium.

And this I call a *Refracted Sound*. But what this Refraction of Sound is, and how caus'd, may hereafter be discuss'd, when the nature and motion or progression of Sounds are well stated.

For the Improvement of *Refracted Vision* artificial Instruments have been made, by grinding or blowing Glasses into a certain Figure, and placing them at due distances; whereby the Object may be (as 'twere) enabled to send forth it's raies more vigorously, and the Visive Faculty impowered the better to receive them. And thus also instruments may be contriv'd for the assisting both the *Sonorous Body*, to send forth it's Sound more strongly, and the *Acoustick Faculty* to receive and discern it more easily and clearly.

For,

I. As a fine *Glass Bubble*, fill'd with clear water, and plac'd before a burning Candle or Lamp, does help it to dart forth it's raies to a prodigious length and brightness:

So

So an *Instrument* may be invented, that apply'd to the *Mouth* (or any Sonorous body) shall send forth the voice distinctly to as prodigious a distance and loudness.

For if the *Stentoro-phonecon* (which is but a rude and unartificial Instrument.) does such great feats; what might be done with one compos'd according to the rules of Art? whose *make* should comply with the *Laws of Sonorous Motion* (which that does not) and therefore not so much *Refract*, as to alter and confound the *Tone of the Voice* and words (as that somewhat does.)

Now of what use such an Instrument might be for speaking clearly and articulately at a distance, (and that without altering the *Tone of the Voice*) whether it be at Sea or at Land (but especially at Sea in tempestuous weather and in the night) is obvious to any man to conceive.

2. As Instruments have been invented to help the *Eye*. So likewise are there some, and more such there may be, for the *Ear*.

For,

1. As *Spectacles* and other *Glasses* are made to help the *Purblind* and weak *Eyes*, to see at any competent distance: So there are *Otaousticks* (and better may be made) to help weak *Ears* to hear at a reasonable distance also. Which would be as great a help to the infirmity of Old Age, as the other invention of *Spectacles* is, and perhaps greater; forasmuch as the Hearing what's spoken is of more daily use and concern to such men, then to be able to *Read Books* or to *View Pictures*.

2. As *Respective Glasses* and *Telescopes* help the *Eye* to see Objects at a very great distance, which otherwise would not be discernable; in like manner may a sort of *Otaousticks* be so contriv'd as that they shall receive in *Sounds* made at a very great distance also; but with so much advantage, that the *Ear* shall be able to hear them, which otherwise would have been *inaudible*.

And these *Otacousticks* in some respects would be of greater use then *Perspectives*. For whereas at land *Perspectives* are many times render'd almost useles, by the interposition of Woods and Mountains, which hinder the *Sight* from reaching very far : our *Otacousticks* would, notwithstanding these Obstacles, take in a Sound made some leagues off. Which might be of notable use in the time of War, for discovering the Enemy at a good distance, when he marches or lyes incamp'd behind a Mountain or Wood, or any such place of shelter.

Yea even at *Sea* also, where *Perspectives* are of most use, by reason of the plainels of the surface of the Water ; Yet sometimes there *Otacousticks* may be of more benefit, when in dark, hazy weather the air is too thick, or in Stormy Tempestuous weather the Waves rise too high, for the *Perspective* to be made use of.

But whether at *Sea* or *Land*, *Perspectives* become altogether insignificant in the night time (unless it be for viewing the Stars) which is the chief time for using *Otacousticks* ; as it is generally, for Souldiers to take their march, when they would surprize their Enemies.

And therefore this sort of *Otacousticks* have then their chief use, when *Perspectives* are of no use at all ; besides that they may be employ'd in the day time, as well as *Perspectives* ; whence they may (not unfitly) be term'd *the most useful Instrument* of the two.

3. As *Microscopes* or *Magnifying Glasses*, help the *Eye* to see near *Objects*, that by reason of their smalness were *Invisible* before ; which *Objects* they *Magnify* to a strange greatness : So *Microphones* or *Micracousticks*, that is, *Magnifying Ear Instruments* may be contriv'd after that manner, that they shall render the most minute Sound in nature distinctly *Audible*, by *Magnifying* it to an unconceivable loudness.

By the help hereof we may hear the different cries and tones, as well as by *Microscopes* see the divers Shapes and
Fi-

Figures , of the smallest Animals.

4. As by *Polyscopes* or *Multiplying Glasses*, one thing is represented to the *Eye* as many, whether in the same or different shapes (for so multiplying Glasses may be contriv'd:) so by a *Polyphone* or *Polyacoustick* well order'd one Sound may be heard as many, either of the same or a different Note. Inasmuch that who uses this Instrument, he shall at the Sound of a single Viol seem to hear a whole Consort, and all true Harmony. By which means this Instrument has much the advantage of the *Polyscope*.

And thus much may suffice for comparing the Improvements made upon *Refracted Seeing and Hearing*; I call it *Refracted Hearing*, because made through a Medium, viz. thick Air or an Instrument, through which the Sound passing is broken or refracted.

III. *Reflected Vision* has been improv'd by the invention of *Looking-Glasses* and *Polish'd Metals* whether *Plane*, *Concave* or *Convex*; and these two last either *Spherical*, *Oval*, *Cylindrical*, *Conical*, *Hyperbolical*, or of several other shapes; all which cause a different reflection, and vary the *Phænomena*.

Thus also *Reflex'd Audition*, made by *Ecchoes*, may be improv'd, by contriving several sorts of *Artificial Ecchoes*; as 'tis no hard matter to do in almost any place.

For (Speaking in the general) Any Sound, falling directly or obliquely upon any dense body, of a Smooth (whether Plane or Arch'd) Superficies, is beat back again and reflected, or does *Eccho* more or less.

I say (1) falling directly or obliquely; because, if the Sound be sent out and propagated parallel to the Surface of the Dense Body, or be made so far off and so weak, that it cannot reach it; there will be no reflection of Sound, no *Eccho*.

I say (2) upon a body of a smooth superficies; because if the surface of the *Corpus Obstant* be uneven, the Air by
re-

reverberation will be put out of it's regular Motion, and the Sound thereby broken and extinguish'd: So that tho' in this case also the air be beaten back again, yet Sound is not reflected, nor is there any Eccho.

I say (3) *it does Eccho more or less*, to shew, that when all things are, as is before describ'd, there is still an Echoing, though it be not always heard, either because the *Direct Sound* is too weak to be beaten quite back again to him that made it; or that it does return home to him, but so weak that without the help of a good *O-tacoustick* it cannot be discern'd; or that he stands in a wrong place to receive the reflected Sound, which passes over his head, under his feet, or to one side of him; which therefore may be heard by a man standing in that place, where the reflected Sound will come, provided no interpos'd body does intercept it; but not by him, that first made it.

I shall further make out the comparison 'twixt *Reflex'd Vision* and *Audition* by these following *Propositions*.

1. As a *Plane Speculum* reflects the *Object* in it's due *Dimensions* and *Colours*; allowing for their difference of appearance according to their distance: So a *Plane Corpus Obstans* reflects the *Sound* back in it's due *Tone* and *Loudness*; if allowance be likewise made for the proportionable decrease of the *Sound* according to it's distance.

2. As a *Convex Speculum* reflects the *Object* *Less*, but somewhat *brighter* or *clearer*: So a *Convex Corpus Obstans* repels the *Sound* (insensibly) *smaller*; but somewhat *quicker* (though *weaker*) than otherwise it would be.

3. As a *Concave Speculum* reflects the *Object* *Bigger*, more *Obscure* and *Inverted*: So a *Concave Corpus Obstans* Echoes back the *Sound* (insensibly) *Bigger*, *Slower* (though *stronger*) and also *inverted*; but never according to the order of words. Nor do I think it possible for the Art of man to contrive a *Single Eccho*, that shall invert the *Sound* and repeat backwards; because then the words last spoken,

spoken, that is, which do last occurre to the *Corpus Ob-*
stans, must first be repell'd; which cannot be. For
 where in the mean time should the first words hang and be
 conceal'd or lie dormant? Or how, after such a pause, be
 reviv'd and animated again into Motion? Yet in com-
 plicated or *Compound Echoes*, where many receive from
 one another, I know not whether something that way
 may not be done.

From the *determinate Concavity* or *Archedness* of these
 reflecting bodies it comes to pass, that some of them,
 from a certain distance or posture, will Echo back but
 one determinate Note, and from no other place will
 they reverberate any; because of the undue position of
 the Sounding Body. Such an one (as I remember) is
 the Vault in *Merton Colledge in Oxford*.

4. As a *Speculum* takes in and reflects more of it's Ob-
 ject, when plac'd at a great distance from it, then when
 nearer; because it reflects according to the apparent
 magnitude of the body at such a distance, which is less:
 So also the *Echoing body*, being remov'd farther off,
 reflects more of the Sound, then when nearer. And this
 is the reason, why some Echoes repeat but one Syllable,
 some one Word, and some many.

5. As *Specula's* may be so plac'd, that reflecting one
 upon or into the other, either directly or obliquely, one
 Object shall appear many; as in *Sir Samuel Morlands*
Glass-room: After the same manner *Echoing bodies* may
 be so contriv'd and plac'd, as that reflecting the Sound
 from one to the other, either directly and mutually, or
 Obliquely and by Succession, out of one Sound shall
 many Echoes be begotten; which in the first case will be
 all together & somewhat involv'd or swallowed up of each
 other; and thereby confus'd (as a face in Looking-glasses
 obverted;) in the other they will be distinct, separate and
 succeeding one another; as most *multiple Echoes* do.

Moreover a *Multiple Echo* may be made, by so place-

ing the *Ecchoing bodies*, at unequal distances, that they reflect all one way, and not one on the other; by which means a manifold successive Sound will be heard (not without astonishment;) one clap of the hands like many, one ha like a laughter, one single word like many of the same tone and accent, and so one Viol like many of the same kind imitating each other.

Furthermore, as *Specula's* may be so order'd, that by Reflection they shall make one single thing appear many different things; as one single man to seem many men differing as to shape and complexion (or a company of men) which I think Sir *Samuel Morlands* contrivance does not: So may *Ecchoing Bodies* also be order'd, that from any one Sound given, they shall produce many Ecchoes, different both as to their *Tone* and *Intenson*. (The ground whereof has elsewhere been laid down in a Treatise concerning the *Sympathy of Lute-Strings*.)

By this means a *Musical Room* may be so contriv'd, that not only one Instrument, played on in it shall seem many of the same sort and size; but even a Consort of (somewhat) different ones; only by placing certain *Ecchoing Bodies* so, as that any Note (play'd) shall be return'd by them in 3^{ds} 5^{ths} and 8^{ths}, which is possible to be done otherwise then was mention'd before in *Refracted Audition*.

I have now done with my *Comparison* of the two Noblest *Senses* and *Sciences* as to their *Improvements*, wherein I have been thus large, that I might give you a little prospect into the *Excellency* and *Usefulness* of *Acousticks*, and that thereby I might excite all that hear me, to bend their thoughts towards the making of Experiments for the compleating this (yet very imperfect, though noble) Science; a *Specimen* whereof I will give you in three *Problemes*, and then present you with the *Semiplane* of an *Acoustick* or *Phonical Sphear*, as an attempt to explicate the great *Principle* in this Science, which is *The Progression of Sounds*. The

The Problems are these,

1. *Sonum intendere quousque velis; or, Datum sonum ad datum gradum intendere.*

2. *Sonum Extendere quousque velis; or, Datum Sonum ad datum distantiam extendere seu propagare.*

3. *Sonum transire ab extremo ad extremum et non per Medium.*

1. The first is, *To make the last Sound* (by the help of Instruments) *as loud as the greatest; a whisper to become as loud as the shot of a Canon.*

By the help of this *Probleme* the most minute Sounds in nature may be clearly and distinctly heard.

2. The second is, *To propagate any (the least) Sound to the greatest distance.*

By the help hereof any Sound may be convey'd to any, and therefore heard at any, distance, (I must add, within a certain, though very large Sphear.)

Moreover by this means a *Weather-cock* may be so contriv'd, as that with an ordinary blast of Wind it shall crie (or whistle) loud enough to be heard many Leagues. Which happily may be found of some use, not only for *Pilots* in mighty tempestuous weather, when *light houses* are render'd almost useles: But also for the measuring the strength of Winds, if allowance be made for their different Moisture. For I conceive, that the more drie any wind is, the louder it will whistle *cæteris paribus*; I say, *ceteris paribus*, because, besides the strength and drieness of Winds or breath, there are a great many other things (hereafter to be consider'd) that concur to the increase or magnifying of Sounds, begotten by them in an Instrument expos'd to their violence, or bown into.

3. The third *Probleme* is, *That a Sound may be convey'd from one extreme to the other (or from one distant place to another) So as not to be heard in the middle.*

By the help of this *Probleme* a man may talk to his freind at a very considerable distance, so that those in the middle space shall hear nothing of what passed betwixt them.

Fig. 2.

Semiplanum Sphæræ Phonicæ seu Acousticæ.

You are to conceive that (rude) *Semiplane*, as Parallel to the *Horizon*. For if it be Perpendicular thereunto, I suppose the upper extremity will be no longer *Circular*, but *Hyperbolical*, and the lower part of it suited to a greater Circle of the Earth. So that the whole *Phonical* Sphear (if I may so call it) will be a Solid *Hyperbola*, standing upon a *Concave Spherical* Base. I speak this concerning *Sounds* made (as usually they are) nigh the Earth, and whose Sonorous *medium* has a free passage every way. For if they are generated high in the Air, or directed one way, the case will be different; which is partly design'd in the inequality of that draught.

Certain Observations of the Midland Salt-Springs of Worcester-shire, Stafford-shire and Cheshire.

Of the Crude Salt, which grows from the Stone-powder dejected by the said Brines in Boiling. Of the Specific difference betwixt Sea Salt and Common Salt.

A way (which seems to be the true method of Nature) of Distilling Sweet and Fresh Water from Sea Water, by the Breath of Sea Plants growing in it.

That this Breath probably is the Material Cause of the Trade or Tropick Winds. In a Letter to the Publisher from the learned Martin Lister Dr. of Physick of the University of Oxon.

S I R,

I Made all the *Wiches* or noted salt Springs in my way home from *Bath*, the last Summer, and spent some few hours in the examining of them. And what particulars I found over and above not mentioned in the *Phil. Transact.* ^f where they are very accurately writ of, I am about to tell you, as follows.

But before I proceed I must needs bear witness to the truth of Dr. *Guidots* experiments, most of which I tried my self at *Bath*, and find him to be a most *Authentic*, and faithful writer. I do only yet doubt of the existence of *Bitumen* for I cannot find the Floating Scum when dried to have any such thing in it.

At *Northwich* in *Cheshire* upon the *Weever* in 4 Pits is great plenty of *Brine*, it stinks of *Sulphur* Apparently in all the *Pits*; it becomes *Atramentous* with *Galls*.

Here are used *Sand Pans*, which are let down in the Corners of the great *Iron Boilers*, before the Salt shoots into grains, and these catch the Sand.

^f N. 53. N. 54. N. 142.

Besides there are thick *Stone Flakes* raised from the Bottom of the said *Iron Boylers*, once a week.

N. B. Within half a Mile of these *Brine Pits* at *Marberry* a *Salt Rock* was found by the *Augur* in boring for *Coals*^a.

Here, and at *Midlewich*, also at *Nantwich* and all along the *River Weever*, which are places many miles distant, sink on either side of the *River*, and you will scarce miss of *Brine*, as I was credibly informed by the most knowing men in that particular: But yet it proves a venture whether the *Brine* will be strong enough to boyl, and turn to Account; and for this Reason their *Pits* sometimes fail them, to their great loss (as they shewed me one, which had been wrought to very great profit,) by a small sweet Spring breaking into it, and sometimes the *River Weever* it self does them this mischief.

At *Nantwich* upon the same *River*, is one very large *Brine-Pit*: This water also plainly smells as it were corrupted, or like *Sulphur*, but notoriously upon a few days forbearance of the *Pit*. It becomes *Atramentous* with *Galls*.

It yeilds a *White Sand* or *Stone* adhering in the manner of thin Scales to the Bottom of the *Iron Pans*, in which the *Brine* is boiled. And thus much of the *Cheshire Brine Pits*.

Weston Brine Pit near *Stafford*. This water in the *Pit* Stinks like rotten *Eggs*: with *Galls* it becomes suddenly *Atramentous*. It Purges and Vomits violently, and that drank in a small Quantity. Here are used *Sand-pans*, to catch the white Sand, and there are flakes of *Stone* also, raised from the bottom of the great *Iron Boylers*.

Droitwich in *Worcestershire*. The upper *Wich* or *Brine-Pit* is very neatly kept, and exceedingly drawn, because there are so many *Proprietors*, and but a small *Pit*, com-

^a Phil. Trans. N. 66.

paratively to those which have been named above.

Here the *Salt* is boiled in small *Leaden Pans*, and there is not the least grain of *Sand* at any time, which either falls before the *Graining* of the *Salt*, or that adheres to the *Pans* bottoms; ^b notwithstanding what hath been said to the contrary: and therefore this *Brine* being naturally without *Sand*, it must yeild the more wholesome *Salt*.

The *Lower Pit* at the nether *Wich* in the same Town, hath but one Proprietor, as I remember, and therefore is less drawn, but yet is constantly and well wrought.

Here also is no news or knowledge of any *Sand* at all. The water of these *Pits* stinks like *Rotten Eggs*, especially after Sundays rest: And (N. B.) will, if flesh be pickled in them, make it stink in 12 Hours.

And yet the *Salt* that is boiled out of these *Pits* is accounted the very best inland *Salt* of *England*, and I beleive as good as any in the world.

I doubt not but they are *Atramentous*; but I forgot to try them with *Galls*.

I observed in a Ditch over against then ether *Wich*-houses, the water standing with a *White Scum* as at the *Sulphur Spaws* in *York-shire*.

I shall add by way of Corollarie,

1. That all our *York-shire Wells* called *Sulphur Spaws* (which are many) are no other then so many *Brine Pits*, and if they were well drawn and wrought would be as little offensive in smell.

2 That this *Stone-powder* is also to be found adhering to the *Iron-pans*, where the *Sea-water* is boiled into *Salt*, as it is at *Shields* in the Bishoprick of *Durham*; But I do not remember it to be in the lead pans at *Med p* and *Milthrop* in *Lancashire* where the *Sea Sands* are lixiviated, and that *Lixivium* boiled into *Salt*; nor is it remembred in the ac-

^b John Collins S. and Fish p. 8. 52.

count given^e of the making of *Sea-Salt* by *Insolation*; Nor could I observe it in the least in distilling of *Sea-water* in a *Glass still*, or in the *Yorkshire* stinking Wells, of which a good quantity is yearly made for *Medical* use or rather *Curiosity* to vend to Strangers.

N. B. This *Sand* falls to the Bottom before the *Salt* grains.

This is so also in all other *Mineral Salts*, whose Brines being boiled, ever let go first this *stony* part: the *Okar* falls in powder upon the first boyling but the *Lapis Calcareus* rises in flakes like *Wafers*, which yet falls in powder by frost, as we have elsewhere observed.

3. This *Stone powder* irrigated with fair water and kept moist does yeild an immature *Salt* of an uncommon figure; which I have described at large and figured^d.

4. Notwithstanding the great *Affinity* betwixt the *Salt* of the *Midland Brine-Pits* which is *Common Salt*, and the *Sea Salt*: I must not omit (amongst others^e) a *specifick* Difference, which is by me, (that I know of) now first published, and which, in my Opinion, makes the *Sea-Water*, a Water of its own kind: and also shews that none of the Productions of incinerated *Plants* are truly a *Marine Salt*.

The *Angles* of the *Crystals* of *Common Salt*, boiled out of the *Midland Brine-Pits*; as also of *Sal Gem* or *Rock Salt*, which I take to be one and the same, are intire, and so are all those *Lixivated-marine Salts* so called and described by Dr. Grew. But the *Angles* of the *Crystals* of true *Sea Salt* are ever some of them cut off into *Triangular planes*, at least on one of the sides. And this I learnt, by suffering a *Bottle* of *Sea Water*, taken up upon the *Coast* at *Scarborough* where no river near enters it, to evaporate leisurely placed in the shade, after it had been half boiled away: and here all the *Crystals* (which were many,

c Phil. Transf. N. 51. d DeFontib. Med. Angl. edit. 2. e N. P. The Inland Brine Pits yeild no bitterness, of which see Mr. Collins. p. 54.

and of different Magnitudes) did yet agree in a like figure, as is described.

This *Experiment* I repeated with the like success; and do not doubt, but that it will succeed with any *Sea Water*, which shall be brought from any other part of the world, which this *Society* shall please to direct to be done.

Further, I say that probably the *Sea-water* was the only *Element of Water* created at the beginning. And the congregation of the waters was called *Sea*. *Genes.* 1. that is, before any *Animal* or *Vegetable* was created, or the *Sun* it self. But upon the *Creation* of these the *fresh water* had its rise accidentally, because it owes its being in great part (as I have elsewhere shewn) to the *Vapours* of *Plants* and the *Breath* of *Animals* and the *Exhalations* raised by the *Sun*. and by this means the *Rivers* may be furnished from the *Sea* by the *Breath* of its own *Plants* and *Animals*, so as to make what the wise man says very intelligible. *Eccles.* 1. All the *Rivers* run into the *Sea*, and the *Sea* is not full; into the place from whence the *Rivers* come, thither they return again; that is by way of *Exhalation* and *Vapours*.

5. Now that the *Sea water* is made *fresh* by the *Breath* of *Plants* growing in it, I have elsewhere demonstrated thus; I took a long *Glass Bodie* and having filled it pretty full with *Sea-water*, taken up at *Scarborough*, I put therein common *Sea weed* (*Alga Marina*) fresh and new gathered, some with the *Roots* naked, and some growing on and adhering to *Stones*: the *Glass Bodie* being full, I put thereon a *head* with a *Beck*, and adapted a *Receiver* thereto, all without any *Lute* or closing the joints; from these *Plants* did distil dayly (tho' in a small quantity) a fresh, very sweet, and potable *Water*, which hath no *Empegreuma*, or unpleasant taste, as all those distilled by fire necessarily have.

I urge this *Experiment*, as the most *natural*, most easy, and most safe way of having *sweetwater* from the *Sea*, and which may be of greater use then perhaps some are apt at the first to fancy, even to supply the *Necessity* of *Navigators*.

6. And I do not doubt but there may be found other *Plants* growing in or near the *Sea* which would better suit the *Experiment* and yeild *fresh water* in much greater quantity; such as *Rock Sampire* the *Kali* kind, or the *Brassica Marina* &c. for all or any of these may be tryed how they will thrive in *Sea water* alone, or planted in earth well and daily wet with it.

Among the known *Sea Plants* the *Sargosse* or *Lenticula Marina*, is not to be forgot; this grows in vast quantities from 36 to 18 *Degrees Northern Latitude*, and elsewhere upon the deepest Seas. And I think (to say something by the by of that great *Phænomenon* of the *Winds*) from the daily and constant breath of that *Plant*, the *Trade* or *Tropic Winds* do in great part arise: because the matter of that *Wind*, coming (as we suppose) from the breath of only one *Plant*, it must needs make it constant and uniform: Whereas the great variety of *Plants* and *Trees* at Land must needs furnish a confused matter of *Winds*: Again the *Levant Breezes* are briskest about *Noon*, the *Sun* quickning the *Plant* most then, causing it to *breath* faster, and more vigorously; and that *Plants* mostly languish in the *night* is evident from many of them, which contract themselves and close at that time; also from the effects of our *Winters* upon them, which cause them to cast both fruit and leaves too; whereas they are said (the same *Plants* for kind) universally to flourish all the year alike within the *Tropicks*.

As for the *direction* of this *Breeze* from *East* to *West*, it may be owing to the *General current* of the *Sea*, for

a gentle *Air* will still be lead with the *stream* of our *Rivers*, for example. Again every *Plant* is in some measure an *Heliotrope*, and bends it self, and moves after the *Sun*, and consequently emits its vapours thitherward, and so its *direction* is in that respect also owing in some measure to the *Course* of the *Sun*.

An account of the increase of Weight in Oyl of Vitriol expos'd to the Air.

SINCE the Excellent Mr. Boyle has made the *Air* a Subject of his Observations, the Learned World is sufficiently taught how vast a share it has in producing many effects, which Philosophy never so much as dream'd of before; and if, upon the hint experiment has given us, we reflect on the infinite variety of *steams* constantly emitted from all sorts of Bodies into the *Atmosphere*, which are there *dissolv'd* as it were in a common *Menstruum*; we have reason to expect therein *particles* enough of all *shapes, sizes* and *motions* fit and proper to alter the texture, diminish or increase the Bulk and weight, of almost any *body* expos'd to its action.

As to the Increase of *Weight* (the business in hand) we know how bodies Rob'd of some constituent parts by fire (as *quicklime* and *all calxes*) slacken and greedily imbibe something from the *Air*; and the like is observ'd in the *caput mortuum*, of *Salt*, *Nitre*, *Alum* and *Vitriol*. On the same score all *fixt Salts* run into a fluid *per deliquium*; 'Tis the *Air*, that in *seven years* fully reimpregnates the earth heap't up in the shade whence *Nitre* was before extracted; 'tis the *Air* that causes the *Efflorescence* of *Marcasites* and *Vitriol-stones*; 'tis the *Air* that by its *acid* turns the *lead* of old buildings into *Cerusse*, which without doubt increases in *Weight*, (as that made by fire does) which is asserted to be at the rate of six or seven pound in an hundred. The same *Growth* of *Metals* seem to acknowledge the same origine, and there are none (*Gold* it self not excepted) but what *Agricola*, *Gerhardus* and some other *Metallick Writers* observe to have increas'd considerably by the free access of *Air* to the *Shafts* and *Groves*; and the very heaps of *Rubbish* wash't from *Tin Oar's* here in *England* have within the memory of man, nay in 10 or 12 years been wrought over again with great advantage:

now though we must perhaps acknowledge in some of these Instances, that the particular *Seminal principle* specifies these new acquir'd parts; and determinately makes them *Mineral* or *Metallick* of the name and nature of the *Matrix* into which they are received, yet this is certain; the addition of *weight* is owing to a *Substance* communicated by the *Air*. *Instances* of this nature concerning the *growth* of Lead, Iron, Tin, Silver and Gold with the *Increase* of other bodies are succinctly collected and with his *wonted Sagacity* remarkt on by Mr Boyle in his tracts on that subject. So that the *Increase* and *attractive power* of *Solids* is a Theme already fairly cultivated and put beyond question: But that *liquids* such as seem *Saturated* with their own *moysture* should nevertheless imbibe more from the *Air* is not mentioned by any Author I know of, except the aforefaid *Learned person*, who in his Tract of *Aerial magnets* advices tryals upon the *liquid preparations* of *Vitriol*: I have heard indeed some Druggists have accidentally taken notice of this encrease in *Oyl* of *Vitriol*, (and perhaps have improv'd it to their own gain though to the detriment of the buyer,) but the observation never was prosecuted with any method or certain account how much the said *Increase* was, and what the *substance*, gain'd.

The Industrious Chymist Mr. White our University Operator, having a *Viol* of that liquor *unstopt* and constantly *running over*, first gave occasion to the following notes: but since from thence no true estimate of the just *Increase* could be collected, I hope it may not prove altogether ungrateful to the *Curious* to give you, in answer to your request, what has occur'd more particularly on this subject, and I do it the more readily because the R. S. have thought it a thing not to little for the press.

On the ninth of No. 1683. Three Drams of *Oyl* of *Vitriol* so far Dephlegm'd as to burn or *Corrode* a strong pack-

thred assunder, was *expos'd* to the *Air* in a *Marmalade Glass* of *three Inches* Diameter, and plac't in a nice pair of Scales, in a Room where no fire nor Sun came; Its *Increase* for *7 natural days* divided by *less* portions of *time* was according to the following Table.

A TABLE

A TABLE.

D. Hour. Gain. Space of time. Weath. Wind. Sum of gain. Natural Day.

9	5 pom.	3 Dr. 0 Scr. 0 Gr.	H.				
	11 pom.	gain 0 fere 19	6	Moist, Moist &	Southerly.	Dr. Scr. Gr.	1 st .
10	8 mat.	I 12	9	Windy,	N. Westerly.	I 0 8	
	11 mat.	0 8	3	Rainy Morn.			
	5 pom.	0 9	6	Clear.			
	11 pom.	0 18	6	Starlight. Cold.		Dr. Scr. Gr.	
11	8 mat.	I 07	9	Bright Morn. mild.	N. W.	0 2 18	2 ^d .
	11 mat.	0 4	3	Mild dry weather.			
	5 pom.	0 9	6				
	11 pom.	fere 0 10	6	Mild dry	N. W.	Dr. Scr. Gr.	
12	8 mat.	0 17	9	clear Morn. Frosty.	North.	0 1 19	3 ^d .
	11 mat.	0 5	3	Overcast	N. more West.		
	5 pom.	0 7	6				
	11 pom.	0 6	6	Cloudy Rain	West.	Scr. Gr.	
13	8 mat.	0 9	9	Cloudy mild.	Southerly.	I 3 $\frac{1}{2}$	4 ^d .
	11 mat.	0 3	3		South-west.		
	5 pom.	0 5 $\frac{1}{2}$	6				
	11 pom.	0 6	6	Cloudy moist	South-east.	Scr. Gr.	
14	8 mat.	0 8	9	Cloudy misty	Southerly.	0 18	5 th .
	11 mat.	0 2 $\frac{1}{2}$	3	Misty			
	5 pom.	0 1 $\frac{1}{2}$	6	Very Warm.			
	11 pom.	0 2	6	Cloudy unusually warm.	more South	Scr. Gr.	
15	8 mat.	0 6	9	Cloudy.	South East	0 15	6 th .
	11 mat.	0 3	3	Cloudy moist.	more South		
	5 pom.	0 4	6	Clear Coldish.	Easterly.		
	11 pom.	0 4 $\frac{1}{2}$	6	Dry Starlight Cold, Cloudy	Easterly.	Scr. Gr.	
16	9 mat.	0 9	10	but Cold	Southerly.	0 17 $\frac{1}{2}$	7 th .
	11 mat.	0 2	2	Cloudy Windy	South-east.		
	5 mat.	0 2	6	Cloudy very mild.			

From

From the 16th. in the successive spaces of twenty four hours, each gain'd one of the number of Grains following, as the 8th. natural day gain'd $13\frac{1}{2}$, the next 12, 9, 7, 6, 5, 5, $4\frac{1}{2}$, 3, 3, 3, 3, 4, 3. (*December*) 4, $4\frac{1}{2}$, 4, 3, 3, &c. still irregularly decreasing till the liquor was satiated.

But these *seven days*, here specified in the *Table*, containing all the considerable variety to be observ'd in this business, it would be *superfluous* and impertinent to trouble the Reader with any longer Diary, which was kept to the 4th. of *January* 1681 when the Increase in 24 hours amounted scarce to *half a grain*, and probably had the weather been then dry, it might have been none at all, or rather the liquor might have *lost* what before it had *gain'd*; as I shall observe by and by to some other purpose. But what is obvious to discourse upon the whole, relates either to the *Manner, Causes, Substance, Quantity* and *Time* of the *Increase*, or to the *Use* that may be made of the experiment in order to the discovering of the *changes* in the *Air*.

As to the first, the *more* our liquor was Saturated, the *less* was its daily increase, though not *gradually* less by an even descent each day, but sometimes 2 or more natural days together it was exactly the *same*, a day or two after *less* and then again *more* the next day following according as the liquor stood affected by the heat or cold, dryness or moisture of the weather, the differing time of the day and quarter of the Wind. Thus upon the view of the whole Diary of almost two months; it appear'd, the increase was *more* in a Moist, Rainy, Misty, and Snowy, but *less* in a Frosty, Clear, and Dry Season, as also was *more* in a Cold than in a Warm Air.

When the Wind was Northerly or Easterly the gain was *less* *ceteris paribus* than when Southerly or Westerly, and was less in the day than in the night.

The *primary* cause of this *Phænomenon* seems to be the *Moisture of the Air*, which our liquor (*a potential fire*) im-

imbibes as greedily, as *actual fire* does the pabulum of Nitre, yet we must allow that all the other *Circumstances of Season* just now mention'd have each their particular influences in diversifying the *quantity* of the *Increase*. Thus it appears in the *Table* that *heat* alters the *progress* of increasing: For on the fourteenth day of *November* from 11 *mat.* to 11 *pom.* (at which time specially towards night) a very unusual and troublesome heat in the Air was complain'd of by several here in *Oxford*) in twelve hours the gain was only three Grains and $\frac{1}{2}$, whereas in the like time preceeding 'twas 10 Grains and $\frac{1}{2}$, and in that just following 9 Grains.

Neither indeed can any thing otherwise be expected from *Heat*, since thereby the *Moisture* might rather be exhal'd; or at least might be suspended, agitated and intimately *mixt* with the *substance* of the Air, and consequently not so easily be *Arrested* and *Entangled* by the surface of the Liquor, as when the Air is less hot. However allowing the effect of this *anomalous accident* at a time of the year when *least* expected, and considering that most commonly *Heat* keeps even pace with the *Season* of the year, depending as to its temper for the most part on the *Nearness* or *Remoteness* of the Sun; we may safely conclude *Moisture* the cheif and only *cause* of the *Increase* of *Weight* in *Oyl* of *Vitriol*, since in *Dry*, *Clear* weather it constantly increases *less* then in *Moist* and *Cloudy*, the circumstance of *Heat* or *Cold* remaining the same in both.

But this will be clearly evinced by an enquiry made into the *nature* of the *substance* gain'd, with the *Increase* of *Weight*. For by the ordinary wayes of tryal it appear'd the *Atmosphere* afforded our liquor nothing besides some of its *watry* particles, wherewith it always abounds, but more especially is ready to *part* with in *Moist* weather.

The *Air* without doubt has great variety of *different Substances* floating in it, whereof *some* particles do adhere
here

here to *this*, some other sort to *that body*, according as either is peculiarly *dispos'd* to receive one sort rather than another. Thus the Mortar in the Joints of old Walls and Vaults from *Corpuscles* attracted from the Air, Sprouts out and frames a *peculiar* kind of Salt. I have known a Deal Shelve moisten'd only with the Liquor of *fixt nitre*, frosted over with Christsals of a perfect *inflamable* nitre by regaining the *proper acid* from the Air, all one as if so much *Spirit of nitre* had been pour'd on the said Liquor; I have seen a *Viol* half fill'd with *Oyl of Tartar per deliquium* (by being left open to the Air,) beset above the Liquor with peculiarly figur'd *Crystalls*, and at the bottom were flat Chrystaliz'd *plates of a Salt* which without flame crackled on a live Coal and left behind a Calx much like *Dr. Lysters nitrum Calcarium*. And tis well known *Colcothar of Vitriol* reimpregnated by the Air, will by a fresh distillation give you its proper *Acid* as at first. Now upon such *hints* as these, some (fond of the doctrine of *Alkali* and *Acid*) might perhaps expect, since differing Bodies of an *Alcalizate* nature do thus regain their *proper acids*, that *vice versa* even this most *acid Liquor Oyl of Vitriol* also might find its *Alcalizate associate* in the Air, from which the *violence of fire* had before driven it, but we could discover no such matter; the *tast* of our augmented Liquor was still purely *acid* and only weaker than before, whereas it would have been *Saltish* had an *Alkali* been combin'd with it, and its colour from a deep *reddish*, became *limpid*, all one as if the like quantity of fair water had been mixt; but to be more certain in this point I distill'd off the new gain'd *Substance*, at first it came over as *insipid* as clear water; and urging the fire farther, the drops prov'd *sowr*, the remaining *Oyl* in the Retort was altogether as *Corrosive* as at first, whence we may infer its *Edge* was not at all *blunted* by any adjoyn'd *Alkali*; so that what the Air afforded was nothing else but *meer water* only.

As to the *quantity* of the whole Encrease it can't be determin'd by any general rule, since it varies according to the different *Strength* of the *Oyl of Vitriol* for it appears by the Table, the *more diluted* the Liquor, the *less attractive* it prov'd. This here employ'd (as highly *Phlegm'd* I presume as any usually is) gave a *triple* and more than $\frac{1}{2}$ of its first weight, amounting in all from three to nine Drams, and thirty Grains before it come to a *Stand*. Which *proportion* of Encrease I found confirmed in *lesser quantities* also; as, three Grains *Encreas't* to more then nine Grains; and one Grain gave the weight of something more than three Grains. But *besides the strength* of the Liquor; there are other *Circumstances*, as the *Season* of the year; and position of the *place*, which will certainly something alter this point; thus our liquor will gain more in *Winter* than in *Summer*; more in a Cellar and *Sunless* Room, than in a Room not so *qualifi'd*.

All these circumstances which relate to the *quantity* will also influence very much the *time* of the Encrease, the last thing to be consider'd in the experiment; but I shall only *mention* that which makes the most peculiar and *principal* variation in this point, and tis the *proportion of the Surface to the bulk of the Liquor*. For I find the *greater* or *less* the Surface is, the *quicker* or *slower* the Encrease. Thus three Grains dropt and diffus'd to nere $\frac{3}{4}$ Inch breadth on a peice of Glass, gain'd three Grains in six hours, one Grain in six more, one Grain and $\frac{1}{2}$ in twelve hours more, in the next 12 hours gained $\frac{1}{2}$ a Grain, and in the last twelve hours it gain'd very little observable; So that in less then forty eight hours, having more then triple its first weight, it was for some time *fully satiated* till *Rainy weather* added something more.

But to discover *more nicely* what intrest the *proportion*

tion of Surface has in *hastening* or *retarding* the increase of weight, I expos'd in the same *Room* and to the same *temper of the Air* (as near as I could Guess) three Drams of the same Oyl of Vitriol in an open flat Glass one *Inch Broad*, being only $\frac{1}{3}$ of the Diameter of that Glass us'd at first with the like quantity. The result was this; that whereas the other Surface of *three Inches Diameter* gain'd (as in the Table) near nineteen Grains the first six hours, this *less Surface* gained a very little perceivable more then two grains in the same space of time. Now since the *Area's* of Circles are to one another as the *squares* of their *respective diameters*; as one the square of the *less* is to nine the square of the *greater* Glasse's diameter; So was the *weight* of a little more than two Grains gain'd in the *narrower Glasse* to near 19 Grains gain'd in the *broader*, wherefore *the time of Increasing bears* as near as can be expected an exact *proportion* to the *Surface* of the Liquor expos'd, and the liquor in the lesser Glass having but $\frac{1}{9}$ part of the Surface of the greater, could not be satiated under *nine times as many days* as the greater. From what has been said it will also follow, that if this three Drams had a Surface in the same proportion to the weight of a Scruple and a Grain *viz.* a little more than six $\frac{2}{3}$ Inches Diam. as that of $\frac{1}{3}$ Inch was to three Grains, the Encrease of both would be *finish'd in the same time*, and would excuse the long attendance of any that shall think it worth while to repeat the experiment. Perhaps too the *different depth* of the Glass together with the *more or less free access* of Air ought to be attended to in this affair: But thus much for the *circumstances* of the experiment.

The only use of it I can at present find will be to estimate *moisture and dryness* in the Air which is evidently suggested by this following observation: That when the

the Oyl of Vitriol is satiated, in the *moistest* weather; it afterward *retains* or *looses* its acquired weight as the Air proves *more* or *less moist*.

Thus the one grain above mention'd after its full Increase often *varies its equilibrium*, viz. in dry weather, the *weights*, in moist, the *liquor* did constantly *preponderate*, and that so *sensibly* that the tongue of the Ballance of $1\frac{1}{2}$ Inch long describ'd an Arch of Variation to $\frac{1}{3}$ of an Inch compass; (which Arch would have been $2\frac{2}{3}$ Inches (had the tongue been but one foot in length) even with that *little* quantity of Liquor, so that if *more* Liquor expanded under a *large* Surface be us'd, the *minute* alteration of *weather* must needs very much more affect it, and a bare pair of Scales will afford an *Hygroscope* as *nice* perhaps as any yet known.

This Ballance may be contriv'd *two ways*, either *such* whose pin should be in the *middle of the Beam*, with a *very slender tapering tongue* of a foot or one foot and a half long, pointing to the divisions on a *broad Arch d plate fixt above* in the handle according to *figure the third in the Table*; or else the Scale with the Liquor may be hung to a point of the Beam very near the pin, and the other extream made so long as to mark a *large Arch* on a board plac'd conveniently for that purpose, as *the fourth figure 1 presents*; The Scale in either may be a concave Glass of *four or five Inches Diameter*.

Lastly, on the division of the Arches should be inscrib'd the *different temperature of the Air* shewn by the Liquor. The fifth Figure gives the lineament of another Hygroscope made of a Viol-string running upon pulleys, and suspending a bullet fixt to the shorter end of an Index, whose other extremity is so long as to describe a *long Arch* by the *falling and rising of the Bullet* upon the *Stretching and Shrinking of the String*

which would be more nice, were the Index fastened to the center of the last pulley. An experiment very obvious, but not taken notice of (as I know) by any writer, and so I thought it not impertinent to be mention'd here among *Hygroscopes*. But tis high time to conclude. I shall only add this *advertisement* that whereas in this experiment only *Oyl of Vitriol* was imploy'd, I have reason to think that *Oyl of Sulphur per Campanam*, as also *Oyl of Tartar per deliquium*, and the *Liquor of Fixt Nitre &c.* may succeed as well; however, Sir, I must leave the prosecution and improvement of this and such like observations to persons who have better instruments and more leasure for such matters than,

Your humble
Servant.

W. G.

Ricreatione dell' *occhio* é della *Mente* Nell' *observation* delle *Chioccioline* Dal *P. Filippo Buonanni* &c. in *Roma*, per il *Varese*, 1681.

HAVING discoursed as it were in his own defence how proper for the diversion of a *Philosopher* these sort of *Speculations* are, as creating a *pleasure* only to him whose *faculties* are *refined* enough to *relish* it; he divides his *Subject*, which is *Shell-fish*, according to the number and figure of their *Shells*, whence arises the distinction of them into *Univalves*, *Bivalves*, and *Turbinated*. The production of these, as to its manner, being much controverted among *Naturalists*, he enumerates and examines the several opinions concerning it, *viz.* That they propagate their own *Species* by their own *Nature* as other *perfect Animals*, as some think, or as others, that they arise from *putrefaction*, as *Insects* have been supposed to do; and some few opinions more subordinate to these two: And not at all acquiescing in, neither confuting, the reasoning and experiments of *Steno*, *Redi*, or *Lyster*, he imbraces the old and antiquated opinion of their being *equivocally* produced out of *putrefaction*, for which he brings little proof besides the well known reasons, and Authority of *Aristotle*.

After this he considers the great variety of *Shapes* and *Colours* which adorn them, and having made some
en-

enquiry into the causes of them, whether they proceed from *Mineral Tinctures*, as we see *lead* is whitened by *Vinegar*, blackt by *Oyl*, burnt to a *Yellow*; &c. he seems to incline to the opinion that they are meerly *Accidental*, and produces experiments to justify the Assertion.

After this, he enumerates the different *Proprieties*, and *uses* may be made of *Shell-fish*, and gives us a general Account of several *Musæum's*, in which are to be seen great and curious Collections of them, as that of *Wormius* at *Amsterdam*, of *Calceolarius*, the *Musæum Cospianum* annexed to that of *Aldrovandus* at *Bologna*, &c. At *Rome*, he tells us of many collections of this nature; as in the Palace of Prince *Pamphilio*; the *Musæum* of Cardinal *Chigi*, the Study of the *Queen of Swedens* Antiquary, and many others.

His second Part contains a plain and succinct Description of the several *species* contained under each *genus*; to which are added their *colours*, the *places* where they are found and whatsoever is particular in each of them, which descriptions refer you to the fourth part of his book, consisting wholly of the figures of them curiously engraven.

The third part is intirely problematical, where he enquires about the generation of *Pearls*, and in what kinds of *Shell-fish* they are found; whether the matter they are formed of be the *dew*; whether they grow from the *Shell*, or are produced in the *body* of the Fish, as also whether they are *diseases* of them, or their proper *fatus*.

He examines the reason why *Shell-fish* are produced rather in the *Sea*, than in *Lakes*, or *Rivers*; as also why more in the *Water* than in the *Earth*, &c. why there is

is not that *variety* of *parts* in them which is found in other *Animals*; for he asserts, and pretends *Anatomy* for it, that they have no *Teeth*, *Heart*, *Bones*, *Liver*, *Gall*, nor *Spleen*, &c. Last of all Supposing the *Concha Veneria* to be the *Remora* of the Antients, he disputes the possibility of its being able to stop a Ship.

OXFORD,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*,
at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St.*
Paul's Church-yard LONDON. 1684.

Fig. 3.

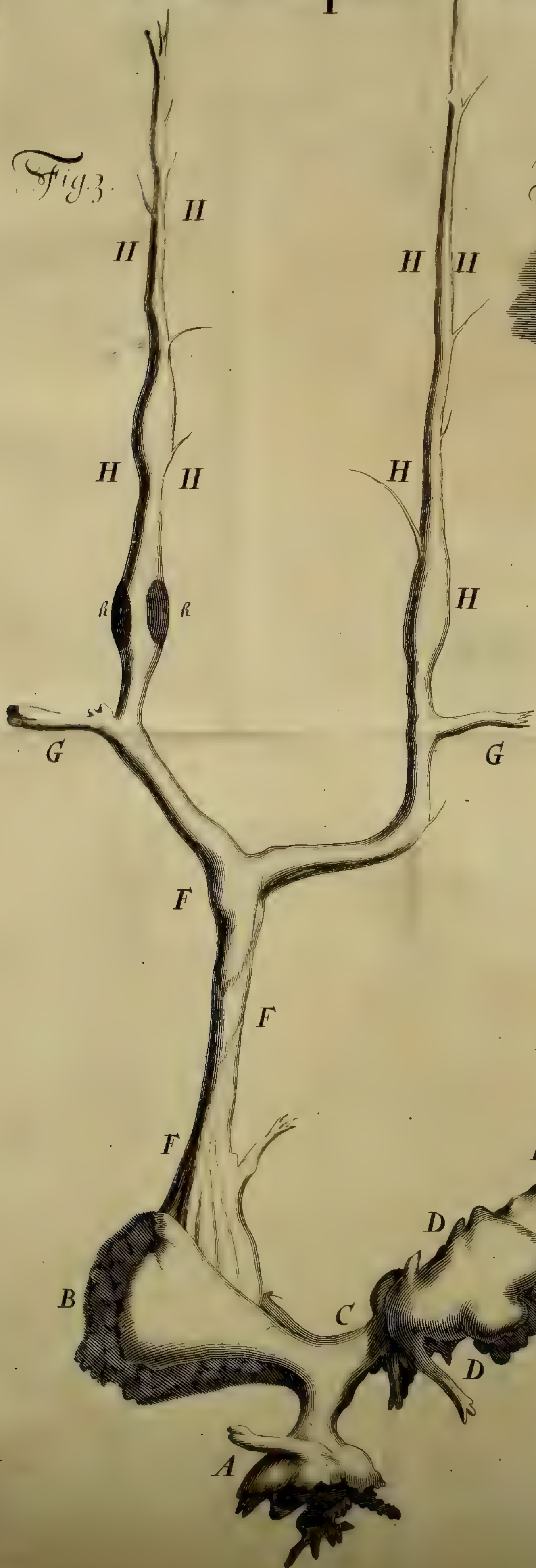


Fig. 2.

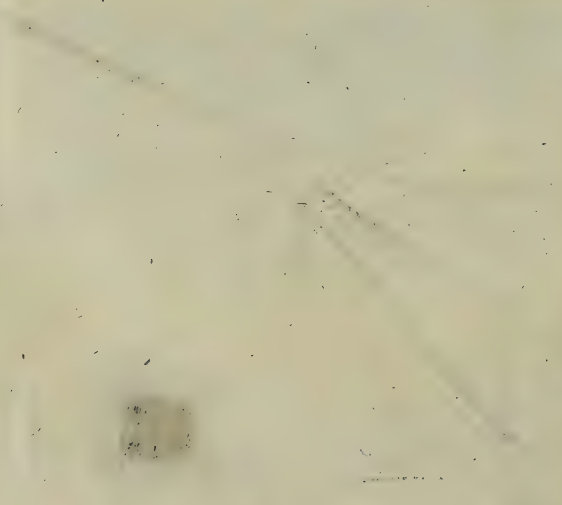
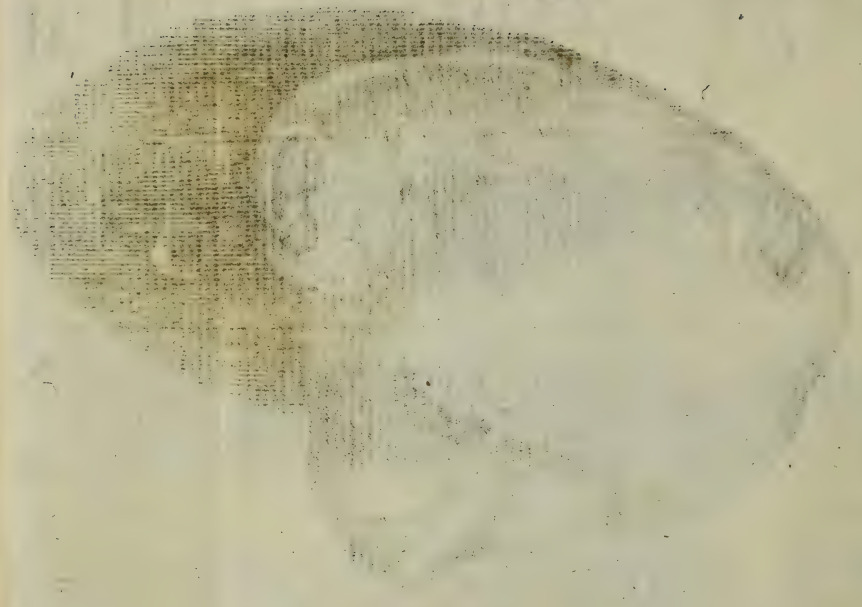


Fig. 1.



Fig. 1.

University of London



PHILOSOPHICAL

TRANSACTIONS.

March 20. 1683.

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Three Papers of Dr. Martin Lyster, the first of the Nature of Earth-quakes; more particularly of the Origine of the matter of them, from the Pyrites alone.

I Have elsewhere^a shewn that the breath of the Pyrites is Sulphur *ex tota Substantia*: Also, That it naturally takes fire of it self: Again, that the material cause of Thunder and Lightning, and of Earthquakes is one and the same; *viz.* The Inflamable breath of the Pyrites, the difference is, that one is fired in the Air; the other, under ground: Of which last, these (I think) are sufficient Arguments: A thing burnt with Lightning smells of very Brimstone; again, the subtlety and thinness of the flame; also the manner of its burning, which is often observed to be *particulatim* or in small spots, vapour like. And of Earthquakes, the Sulphureous stink of waters smelt before, and of the very Air it self after them: of which innumerable instances occur in the relations of them.

They also agree in the manner of the noise, which is, to be carried on, as in a Train fired; the one rowling and ratling through the Air, taking fire, as the vapours chance to drive; as the other fired under ground in like manner moves with desultorie noise, as it shall chance to be continued.

That the Earth is more or less hollow is made probable, by what is found every where in the Mountains; *viz.* Natural Cavities or Chambers, which the Miners of the North call *Self-opens*. These they meet with very frequently, some vastly great, and others less, running

^aDe Fontibus Medicatis Angliæ.

away with small Sinus's. And I doubt not, but upon diligent inquiry, a great Catalogue of such might be had, discovered in the Memorie of Man : Besides many there are, which are known to open to the day, and to discover themselves without digging, as Pools Hole, Oakie Hole, &c. Again, the great and small Streams, which do arise from under the Mountains do evidence the hollowness, and Sinousness of them. Add to these that many *Sinus's* are made in that instant, and are continued by the explosion and rending of the first matter fired; which may, and do, very probably, close again, when the force of that explosion is over; but are sufficiently open to continue the Earthquake.

That these subterraneous cavities are at certain times and in certain seasons full of inflammable Vapours; the Damps in our Mines sufficiently witness; which fired, do every thing as in an Earth-quake, save in a lesser degree.^b

Now, that the Pyrites alone (which is our present Task) of all the known Minerals, yeilds this inflammable vapour, I think it highly probable, for these Reasons.

1. Because no Mineral or Ore whatsoever is Sulphureous, but as it is wholly, or in part a Pyrites: And altho this does contradict the general opinion of the Chymists; yet they must excuse me, if I dissent from them in this particular; for wherever any of them, shall find me Brimstone Naturally contain'd in an Ore; there, I am very forward to beleive, I shall find them Iron also by the load-stone, so that betwixt us, we shall have discovered the Pyrites disguised in that Ore or Mineral. I have carefully made the experiment in very many of the Fossils of England, and do find them all to contain *Iron*, wherever Brimstone, as I have elsewhere declared.

2. Because there is but one Species of Brimstone, that I

^b Vid. Phil. Trans.

know of, at least with us in England : And since the Pyrites naturally and only yeilds it , it is but reasonable wherever Brimstone is found, though in the Air, or under Ground in Vapour, to think that that also proceeds from it.

If it be objected, that there is a Sulphur vive or Natural Brimstone, which is no Pyrites. I answer, that I am not willing to grant this, but do take all pure Sulphur to have been once produced by the fire : For what is found in and about the burning Mountains, is certainly the effects of Sublimation ; and those great quantities of it said to be found about the skirts of the Vulcano's is only an argument of the long duration, and Vehemencie of those fires.

If it be further objected, that the Sulphur Vive, indeed, or ruffe Brimstone, as they call it, had from Hæcla and Italie is Opaque, and agrees not with the transparent and Amber-like Sulphur Vive of the Ancients, so that the mistake is in the Druggists, that we have not right Natural Brimstone ; I reply, that grant the difference, yet it does not follow, that that also was not produced by Sublimation, no more, then that the Stalactites, or water wrought Stone, is not so made for that some of it is found Opaque and some Crystalline.

But this we will grant ; that, possibly, the Pyrites of the Vulcano's or burning Mountains may be more Sulphureous then ours. And, indeed, it is plain, that some of ours in England are very lean, and hold but little Sulphur ; others again very much.

And this may be one reason, why England is so little troubled with Earth-quakes ; and Italie and almost round the Mediterranean Sea so very much.

Another reason is ; the Paucity of Pyrites in England ; where they are , indeed , some little in all places, but mostly *Sparsim* ; and if perchance in *beds*, those are comparatively thinn, to what probably they are in the burning

ing Mountains, as the vast quantity of Sulphur thence sublimed doth seem reasonably to imply: Also, if we compare our Earthquakes, and our Thunder and Lightning with theirs; There it lightens almost daily, especially in Summer time, here seldome; there Thunder and Lightning is of long duration, here soon over; there the Earthquakes are frequent, long, and terrible, with many Paroxysms in a day, and that for many days; here very short, a few minutes, and Scarce perceptible. To this purpose, the Subterraneous Cavities in England are small, and few compared to the vast Vaults in those parts of the World; which is evident, from the suddain appearance of whole mountains and Islands.

If yet it shall be insisted on, that there are other inflammable Minerals besides the Pyrites; we grant there are so, but by the providence of God not to be found in England, that I know of, and not in any quantity in any place of the World, that I can learn: which is well for Mankind, because they are very Poysons, as the Orpiments; but they are all specifically distinct from Brimstone; which as we have shewn, no Ore yeilds but *Iron*; So the Orpiments are all *Gold Ore*; and for such the Emperor *Nero* (as *Pliny* testifies who who was of his time and his Court) caused them to be wrought in quantity, but they would not turn to account. And, by the by, some Authors have assigned this as a good reason, against any Medicine, that shall be made out of Gold (as fond as we are of an *Aurum potabile*) as having naturally a deleterious quality. But this is besides my purpose.

The second Paper of the same person concerning the Spontaneous firing of the Pyrites.

IF it shall be objected, that no Body is kindled by itself: I answer, that it seems to me apparently otherwise,

wife; for that Vegetables will heat and take fire of themselves, as in the frequent instance of Wett Hay: and Animals are naturally on fire, and man doth then sufficiently demonstrate it, when in a Feavour: But amongst Minerals, the Pyrites, both in Gross and in Vapour, is actually of its own accord fired. Dr. *Power* has recorded at large in his *Micrographia*^a a famous instance of it; and the like not very rarely happens. And that damps naturally fire of themselves, we have the general Testimony of Miners, and the same Author.^b

Again the Vulcano's all the World over, argue as much; for we, with great probability beleive them to be Mountains made up in great part of Pyrites, by the quantities of Sulphur thence sublimed, and the Application of the Load-stone to the ejected Cinder. I go further.

That these Vulcano's were naturally kindled of themselves, at or near the Creation is probable, because there is but a certain known number of them, which have all continued burning beyond the Memoirs of any Historie, few or none of them that I know of, have ever totally decay'd or been extinct, unless possibly by the submerfion of the whole, being absorpt in the Sea. Though they indeed, do burn more fiercely sometimes then at others for other reasons. So that it seems to me as natural to have actual fire in the Terrestrial World from the Creation, as to have Sea and Water.

Again if these Vulcano's did not kindle of themselves, what cause can we imagine to have done it; If the Sun; we answer, *Hecla* placed in so extream cold a Climate was kindled for ought I can see by the Natural History of both, as soon as *Ætna*, or *Fuegos*, or the most Southerlie. Not the Accidents hapning from man; for, if man was (as we must believe) created Solitary and Topical, they were none of his kindling, because they seem to be fired

^aPower Microg. p. 61. ^b Id. p. 181.

before the Wor'd could be all over Peopled; besides they are most'y the very Tops of vast high Mountains, and therefore the most unfit for the habitation of man.

If we say Lightning and Thunder or Earthquakes; we beg the question; for the Cause of the one is the Cause of the other, and they are one and the same.

It remains therefore (very probably) that they were kindled of themselves.

I for my part know no Subject in the whole Mineral kingdom so generall and lasting for the fuel of these Mountains, as the Pyrites; which I have said alone to yeild Sulphur, and naturally resolves it self into it, by a kind of Vegetation.

About the durable burning of the Pyrites these are instances. *Scotch-coal* hath less of the Pyrites in it, being mostly made up of Coal Bitumen, and therefore it burns and consumes quickly, and leaves a white Cinder. *Sea Coal*, or that Coal which comes from Newcastle by Sea to us, and for that reason so called, burns slowly; and the *Sunderland Sea Coal* so slowly, that it is said by Proverb, to make three fires; this hath much Pyrites mixt with it, and burns to a heavy redish Cinder, which is Iron, by the magnet. But I have seen, and have a specimen by me of a Coal from Ireland, the Proprietour of the Pits is Sir Christopher Wandsford, which is said to be so lasting, that it will continue twenty four hours red hot, and almost keep its figure: This seems to be in great part Pyrites by the weight and Colour.

The third Paper of the same person, concerning Thunder and Lightning being from the Pyrites.

Here are two sorts of Instances (besides the Arguments I formerly urged, which to me are alone sufficiently

ciently convincing) which very much favour the opinion I lately offered. That Thunder and Lightning owe their matter from the sole breath of the Pyrites : And although I am as loath, and as backward as any man to give credit to such Instances, which seem rather prodigies, then the Phænomena of nature ; yet because they often occur in History, it is at least fitting to bring them under further enquiry and examination, that if they can be confuted as false, so much may be done for Posterity ; and that we at least may not leave upon our Registers, matters of fact not true, if they can be fairely set aside.

The first sort of them are those which tell us of Iron to have fallen in great masses, and also in powder after the manner of rain, out of the Air.

In a part *Italy* it rained Iron in such a year, and in *Germany* a great body of Iron-stone fell at such a time ; the like *Avicenn* affirms. *Iulius Scaliger* say's he had by him a piece of Iron, which was rained in *Savoy*, where it fell in diverse places. *Cardan* reports 1200 stones to have fallen from Heaven, and one of them weighed 120 *l*. some of them 30 *l*. some 40 *l*. very hard, and of the colour of Iron.

Now that which is very remarkable (says *Gilbert* where those instances are reckoned up,) and a very probable argument for the truth of such like instances, is, that it is no where recorded, that it ever rained Gold or Silver Ore, or Tin or Lead ; but Copper hath been also said to have fallen from the Clouds.

(And here I must note by the By, that wherever the *Pyrites* is mentioned by the Antients, it is always to be understood of the *Copper Pyrites* ; they scarce having had any knowledge of the Iron Pyrites) And therefore the raining of Copper makes it yet more probable, because of its great Affinity with Iron (which I shall have occasion some other time to discourse of.)

Now this *Ferrum* or *as Nubegnum*, if there was ever any

ny such, was concentered of the breath of the Pyrites, which we have elsewhere shewn to be the Pyrites *ex tota substantia*.

The other instance, which I say is owing to our Registers, is of Lightning being Magnetick.

For this see the Philosophical Transactions of Mr. *Oldenburg* Number 127.

This I am sure of, I have a petrified piece of Ash, which is Magnetick; that is, the Pyrites in *Succo*; which makes it probable it may be Magnetick also in vapour.

*A Relation of the Effect of a Thunder Clap on the
Compass of a Ship on the Coast of New England.*

ON July 24th. Anno 1681. The Ship called the *Albemarle*, whereof Mr. *Edward Lad* was then Master, being a hundred Leagues from *Cape-Cod*, in Latitude 48^d. about 3^h. p. m. met with a Thunder Storm; the lightning burnt the Main-top-Sail, split the Main Cap in pieces, rent the mast all along; There was in Special one dreadful clap of Thunder, in report bigger then of a Great Gun, at which all the Ships company were amazed; then did there fall something from the Clouds, upon the Stern of the Boat, which broak into many small parts, split one of the Pumps: the other Pump much hurt also; It was a Bituminous matter, smelling much like fired Gun-powder: It continued burning in the Stern of the Boat; they did with sticks dissipate it, and powred much water on it, and yet they were not able by all that they could doe, to extinguish it, until such time as all the matter was consum'd. But the strangest thing of all is yet to be mentioned.

When night came observing the Stars, they perceived that their compasses were changed; as for the Compasses in the Bittakle, the North Point was turn'd clear South. There were two other Compasses unhung in the Locker in the Cabin, in one of which the North Point stood South, like that in the Bittakle, as for the other, the North Point stood West; So that they sailed by a needle whose Polarity was quite changed: The Seamen were at first puzzled to work their Vessel Right, considering that the South Point of their Compass was now become North

North; but after a little use, it was easie to them: thus did they Sail a thousand Leagues. As for the Compass wherein the lightning had made the needle to point Westward, since it was brought to New England, the Glas being broken, it has by means of the Airs comming to it, wholly lost its virtue. One of those Compasses which had quite changed the Polarity from North to South, is still extant in the Country, in the hands of Mr. Increase Mather.

The North Point of the Needle doth remain fixed to this day, as it did imediatly after the lightning caused an Alteration.

A Letter of Sir R. S. concerning the former Relation. Lond. March 8th. 1682.

HAVING already given you the Narrative of the Thunder Storm, I add to it this further account, that Mr. Edward Randolph (who has been four times imployed to New England in his Majesties Service; and coming from thence in May last 1683.) told Mr. Flamstead in August how much that accident was there discourfed of. And being by him enjoyned to make further enquiry into the matter at his return to Boston, he did in December at his Arrival there, speak with Mr. Lad himself, who was in the Storm, and affirmed the same thing, and dictated to him an account fuitable to what you have. But that which you have was in the hands of Mr. Mather a Minister, to whom Mr. Lad had

also presented one of the Compasses, as he had done the other to an English Merchant in Amsterdam, who gave it to the State-house. Mr. Randolph says he pressed earnestly the said Minister to send that Compass, which yet he would not understand. But Mr. Thomas Graves a Physitian of that place, and of good note got from him the account you have, and thinks Mather is writing some book, wherein this story of the Thunder, or this effect of it on the Compass, is to bear a part. Which being all &c.

An Abstract of a Treatise of the Calculus Humanus in answer to several Queries proposed by Sir John Hoskins; by the Learned and Ingenious Fred. Slare M.D. and fellow of the Royal Society.

IT is generally observed by those that have been subject to the *Stone of the Bladder*, that pains in the *Kidnies* were antecedent, which intimates the foundation was first laid there, and afterwards by the *Ureters* and a *Gust of Urine* conveyed into the *Bladder*. The manner of its growth in the *Bladder* is obvious, the *Urine* (by some called *Lotium*) being too highly satiated or impregnated with a ponderous matter (which we here design to examine) precipitates the same at certain times upon the mention'd *Basis* and also on the inward *Superficies* or *Coat* of the *Bladder*, which upon a Relaxation of their distended *Fibræ*, do soe strictly embrace that præternatural substance it finds there, as to overlay it or cloath it with what ever Sediment subsidedt here. That the *Urine* only at some *Intervals* is disposed to let fall this matter, seems probable from this observation that the *Concrete* consists of several *Spherical Superficies*, or round Incrustations, which like so many distinct *Shells* may be parted from each other. Moreover these Incrustations are observed to be very unequal, some much thicker then the other: An argument that the *Urine* continued much longer disposed to depose this *Calculous*

lous matter at one time than at another : or else that it was much more satiated or abounded with this ponderous *Precipitate* at one time than at another, and so laid it over with thicker *Crust* in as short a time.

If we might be allowed briefly to examine the causes that have been assigned to the *Production* of this *Concrete*; I think we cannot well grant *heat* in the *Kidneys* to be a probable efficient Cause; a much more *Intense Heat* than is possible to be found here, being necessary to make *Bricks*, or bake *Sand* and *Earth* into *Stone*. Nor is it necessary to derive the material Cause from such a slimy and roapy or mucilaginous Indisposition of the humours, that may perhaps coagulate and harden into a *Stone*. Such a *viscous Urine* being less apt to precipitate this gritty matter than more thin and limpid *Urine*. For I have found in more than one, where the *Urine* has often been so roapy and stringy that it would draw out into threads upon the application of a stick; but yet we never discover'd symptoms of the *Stone* in the *Kidneys* or *Bladder* of such Persons. Nor do I believe that an *Acid* meeting with some *Alkalies* may be reasonably concluded to constitute this so firm and solid a *Concrete*. Which does not at all hold good in our *Analysis*, nor does it seem reasonable, that *Acids* should make this *Connection*, since nothing that I know of but *Acids* will make the least *Solution*. Now if *Acids* make the first *Bond* of *Union*, we may expect from them rather that they should strengthen and confirm than shatter this *Confederacy* in pieces.

Nor can I charge any putrifying morbid *Ferment* in the *Kidnies* with such a *Coagulating power* as will answer for the *Product*. This *Hypothesis* of *Helmont* being very precarious, and seems grounded on one uncertain Instance, of a Person that upon eating *Asparagus*, from
that

that time contracted the *Stone* in the *Kidnies*, which Plant he much discommends as well as the *Raphani*, upon the score of their ill sent, for disposing the *Kidneys* to putrefaction, and so to breed the *Stone*. Much might be said to invalidate this *Hypothesis*: but the common and innocent use of these *Pl nts* will secure us against this prejudice, upon which *Observation* his *Hypothesis* seems wholly to depend.

We may also except against the Experiment of *Coagulation*, upon the mixtures of high rectified *Spirits* of *Urine* and *Wine*, which if warily managed will make a *Coagulum* with such expedition as seems very strange and surprizing: for this *Concretion* will easily be dissolved by water. In like manner if either of the *Spirits* be very *phlegmatic*, there will follow no *Coagulation*. In so much that the humours of the *human Body* contain too much *water* in them to admit such an Effect, even in those *Constitutions* that have used themselves to very highly rectified *Spirits*. Moreover *Horses*, *Doggs* and other *Animals* that drink no *wine* are not free from this gretty *Cementation*. Nor could I ever discover any drop of *vinous Spirits* afforded upon our *Distillation* of this matter. I would not be thought here to excuse these *Ardent Spirits* from doing mischief to the *human body*, but doe believe that they are apt enough to make ill *Secretions* and some *Concretions* of the humors, (tho' of an other sort) I mean such as are visible enough in the *faces of Great drinkers* and the like. Nor is this disagreeable to our *experiments*, where tho' the diluted and weakened *Spirits* will not convene into a firm harden'd body, yet some lesser and softer *Concretions* will Subside to the bottom of the *Glass*.

We may also question the *Hypothesis* of the *Production* of the *Stone* by *Petrefaction*. Stones are such fixt bodys that they yield nothing upon *Distillation* except a small

Quantity

Quantity of insipid water chance to rise, nor will they *Exhale* very much in an open fire, whereas we can *vitalize* six parts of eight of our *Calculous matter* : and obtaine *Salts* and *oyls*.

But to pass on: The *chymists*, who of all men suppose their *Opinions* the least subject to uncertainty, being grounded on *experiments*; They describe the *Concretions* of the body, and particularly this morbid one by calling them *Tartareous* : who conclude they have sufficiently accounted for the nature of a body, if they can but call it *Tartar*, which must be acknowledged to consist of *Acid*, and *sixt Salts*, called *Alcalizat*, and of some *Tarra damnata*; tho' it be very little in proportion to the other *Salts*.

If we compare such *Analyses* of the *Calculus* which we have often made, with the aforesaid *Tartar*, we may then infer what little reason there is to *Eclipse* its nature by that *denomination*. We Distilled an ounce of *Calculus Humanus*, that was recently cutt out of a body, which afforded about two *drams* of a brown *Spirit*, nearer to that of *Harts-horn* than *Urine*. We put the *Caput mortuum* upon the *Cupel* and reduced it to near a *dram*, the rest burning and smoaking away.

Another time we distilled in a naked fire a *Stone* that weighed two ounces, the *Vapor* came over upon a good streis of fire, and settled in the form of *Salt* without any *liquor*, of which we preserved only a *dram*, it appeared very brown and tasted *bitter*, as the *fetid oil* of *Harts-horn* and other *Empyreumatical Oils* doe. We examined by boyling and evaporating water from the *Caput mortuum*, whether it held any *sixt Salt*, but found none. The *Caput mortuum* weighed one ounce and six *drams*, so that it lost only two *drams* in the *Distillation*; that is only two *drams* came over the *Helme*. We proceeded farther and placed this *Caput mortuum* upon a *Test* in an open fire, where

where it burnt away to two *Drams*, 44 *Grains*: this we also boyled in water to see what salt it held, it scarce afforded a tast of Salt, scarce surmounting that we usually find in the like Quantity of common water.

The *Chymists* do generally pass by one material Circumstance in their *fiery Tryal*: rarely enquiring after that considerable part evaporated in the open fire which in our present *Experiment* proves much the greater proportion of the Body. There being an ounce and three drams of our two ounces evaporated, of which we have no account, I endeavoured to save some of it, (tho I concluded it impossible to preserve very much) by placing a taper Chimney or Tunnel to receive the *Smoak* as the fire and a pair of Bellows raised it, which so far succeeded that I caught above two drams of this *fuliginous Substance*, and some drops of a water of a fetid saline Tast.

To make many experiments with this *Product* it requires a greater Quantity of water than *Lithotomists* will easily furnish us with. The *smoak* of our common fires gives us a *Sublimat*, whose *chymical Principles* are no less considerable than the bodys from whence they ascend. For I lately found them not only to contain *volatile Salts*, *Oyles*, and *Phlgm* with other things, but even a *Salt* so near to common *Sea Salt* that it shot into *Cubic Figures*: much like to that we lately exhibited here in our *Analysis* of *Urine*. But seeing it was then objected that that *Salt* might probably be nothing else but the common *culinary Salt* we constant'y take in with our *Food*, I have since distill'd the *Urine* of *Horses*, that were fed with Hay and Oates, and have obtained the same sort of *Salt*. Both of these *Experiments* confirm Dr. Grew's discovery of *marine Salt* in several *Plants*: which I am apt to think was *Antecedent* there, to its exposition in the open *Air*, for several reasons too large to be here mention'd: having been guilty of a small digression already.

If we now compare this concrete with *Tartar*, we find

the one a *vegetable Salt* wholly *dissolvable* in *water*: the other so stubborn, that several very corrosive *Menstruums*, that will easily dissolve *Iron* and *Copper* and *Silver* and almost any thing, will not make any Impression here. The one affords a little *volatile Salt*, which is *Alcalizat*, and no *fixt Salt*. The other gives no *volatile Salt*, and a very large proportion of *fixt*. The one affords much more *earthy Substance* call'd *Terra Damnata* than the *Hoofes* or *Horns* of *Animals*, &c. and the other leaves us scarce any. One abounds with an *acid Salt*, which is sensible to the palate, and very manifest in the *Spirit* of *Tartar*, but in the other we could discover none upon the narrowest search. This leads us to the *Examen* of *Tachenius* his *Experiment*: which is this.

He puts a whole *Stone* of the *Bladder* into a *Retort*, and distils over a liquor, which he acknowledges to be *urinous*; this done; he pours back the liquor upon the body from whence it was distill'd, which he says reduces this *Caput mortuum* after a short infusion to its former solidity. From whence he concludes some *occult Acid* mixt with this *Alkali*, must needs cause the hardening so friable a body, which, without it, will be apt to crumble into dust like the *Subterranean Carcases* of *Rome*, that molder away upon the least touch.

A great fondness for the *Hypothesis*; made the *Operator* very careless in his Examination. For the *Caput mortuum* he supposes so very pulverisable, I could never find so, but after *Distillation* it remained almost as hard as formerly, and this is certain that upon the Reaffusion of the *Spirit*, it grew rather softer than harder. But if we reflect upon what has been said and experimented before, it will prove unnecessary to argue further against *Tachenius*. Hence we may infer that 'tis very dangerous to give the same names to things that are very opposite in their *Natures*: by this means men are very apt to be led into Errors. Thus the notion of presuming this mat-
ter

ter *Tartareous*, has put men upon using *Medicines* to destroy *tartareous Concretions*, as well as avoid many things that seem to have *Tartar* in them: and yet at the same time perhaps it may be as inoffensive as some of those *Medicines* that are substituted; at least, as *Spirit of Salt* or common *Salt* commended by *Helmont*. In like manner the notion of *Petrification* which seems, from whence the Stone derives its Name, may be no less erroneous, there being no agreement or *Analogy* in their *Nature's* whether we consider them *Synthetically* or *Analytically*. If we consider *Stones in composito*, there is a particular *Weight* or *Gravity* belonging to their *Bulk* in which they *specifically* agree. Several sorts I have weigh'd according to the *Hydrostatical Laws*, I find them agree in being twice as heavy as their *Bulk* of water, and about a fourth part more. This I found true in *Wood*, *Bone*, and *Shells*, when petrified, and even *water* it self, and some other *Bodies* tho never so light in their former state, as soon as they have obtained the form of *Stone* they all become of the mention'd weight or very near it. But this which is called the *Stone* of the *Bladder* is much lighter, and several of them agree in being only as heavy as their *Bulk* of water and a 4th part more. This yields to none but the most potent *Acids* and particularly to *Nitrous* ones alone; the other is dissolved by almost any slight *Corrosive*. The one in our *Analysis* affords various constituent parts, and the other upon *Distillation* only a drop or two of insipid water, the rest remaining fixt. But we need not insist upon the difference which is so obvious.

Since 'tis much easier to quarrel at other's *Hypotheses* than to invent better, in order to the giving some account of the *Cause* of this *Nonnatural Concrete*, I would lay down some Considerations.

This *Concrete* may herhaps owe its *Origine* to a very soft and thin *fluid*; more remotely to the *chyle* strained through the *Guts*, and yet nearer the matter to the *Blood* it self, but

nearest and immediatly to the *Serum* of the *Blood* which seems to be its proper *Vehicle*.

We shall be the less surprized to derive such firm and solid *Productions* from *fluids*, when we consider that there are particles floating in the *Blood* always disposed to be converted either into *Gristles*, or to make up the solid *Skull*, *Nailles*, *Bones*, &c. and that even the *Teeth* whose Texture is very firm, are made and supplied out of the soft *fluids* of the Body.

Even some of these solid parts of the Body may by a *Disease* of the *Blood* be abraded and absorbed by the common *Fluid*, and *precipitated* by their own weight upon the *Pelvis*; or else stick in the *Tubules* of the *Kidnies*, and so choak them up, and by degrees extend them to a *Rupture*, or grind them to pieces by a constant impulse of this gritty substance, which may at last convert the greatest part of the *Kidnies* into this firm *Concrete*.

Moreover without any respect had to these solid abrasions, the *Blood* it self (of which the *Serum* is a great part and with which it is intimately mixt) consists of *heterogeneous Particles*, of so various forms, sizes and shapes, which seems necessary for their accomodating themselves to all parts, that even these design'd to constitute the solid parts, may suffer such irregular changes in the Body, which may unfit them to pass the *emulgent Vein*, and so to continue their *Circulation*. In so much that the continued *Impulse* of this matter by the *Artery* may make very considerable *Aggregates* or *Concretions* in the *Kidneys*.

And not only so but without either respect to *Vein* or *Artery*, the *serous* or watery part of the *Blood*, which we said before was the *Vehicle* of the *Stone*, may have imbibed such heterogeneous gross and ponderous Particles, as may whilst in *circulation*, fluctuate and mix well enough together, but may very easily separate upon the least *Stagnation*. Thus *Water* and *Oyl* unite only by *contact*, and
that

that by a violent Concussion and agitation of their parts, which as soon part as the force is taken off. The various mixtures in a *Torrent* seem to make up one homogeneous *Fluid*, but if some part of this Fluid happen to fall into a Pit, or stagnate in a quiet place, we shall find it clear it self of *Sand*, *Mud* and other *differing parts*. So great a difference there is betwixt the *humors* during their motion and agitation through *Veins* and *Arteries*, and when they are in the quiet Passages of the *Kidneys*, or the more quiet state in the *Bladder*; as there is betwixt a *Torrent* and a *Well*: the first may hurry along with it such gross and ponderous parts, which easily subside in the other.

That the Nature of this Concrete seems rather referable to *Bone* than to any other consistent or fluid part of the Body, I concluded by comparing *chymical* Products which I only very briefly relate.

Having cleared the *Bone* of *Marrow* and *Fat* by boiling it in water, I distilled it and obtained about two drams and an half from an ounce of *Bone* of a volatile liquor impregnated with *Salt*, that smelt very much like that I have mention'd, which was very differing from Spirit of *Urine*; and nearer that of *Harts-born*: I found the *caput mortuum*, as to weight, very consonant; and also could extract no manner of *salt* from it. For which reason *Refiners* make their *Cupels* of *calcined Bones*, they being forced to dulcify (which they call washing out the *salts* of) other *Asbes* before they can make *Cupels* of them. Last of all it herein also agrees with the *calculus Humanus*, vulgarly so termed, that few *Acids* will dissolve it, excepting those that are *nitrous*, nor do these work on it very vigorously.

Herein they must be al'ow'd to differ in their *specific Gravity*, the *Calculus* not having so close and compact a Texture as the *Bones* have. For *Bones* I have found twice as heavy as their Bulk of water.

*An Index of some Experiments made in this
short Treatise.*

Several Stones of the *Bladder* and *Kidnies* were distill'd, all afforded *volatile urinous Salts*; which Ferment upon any *Acids*. *Bones* were distill'd and found to be of agreeable *Principles*.

Petrifi'd Water affords only fresh and clear water upon distillation.

Calculi examined *Hydrostatically*, were found in proportion to their Bulk of water as 5 to 4.

We weigh'd *Flint*, *Crystal*, *petrifi'd Water*, *Welch Diamonds*, *petrifi'd Wood* in water, and found them all very near of a *specific Gravity* and almost as heavy again as our *calculous* matter.

We weigh'd *Bones* *Hydrostatically* and found them twice as heavy as their Bulk of water.

Bones not easily wrought on by common *Acids*, only by *nitrous* ones and that without *Ebullition*.

Various unsuccessful attempts made to dissolve the *Calculus*, by *acid* and *Acrimonious Menstruums*, some were *Vegetable* and some *Mineral*, as *Spirit of Salt*, of *Vinegar*, of *Venus*, *Oyl of Vitriol*, &c. also with *Alkalifat acris*, as *Sal Fraxini* (which corrodes *Glass*) *Lapis Infernali*, but none would touch it except *nitrous*.

The *Coagulation* of *Spirit of Wine* has no place here

Experiments to be made Relating to the Therapeutic Part.

TO discover innocent *Menstruums* that may dissolve the *Stone*.

To examine the Condition of the *Urine* sometimes before a *Paroxysm* both as to its *specific Gravity* and *Contents*.

And also during the *Paroxysm* to regard the painful water sometimes transmitted.

To enquire into the *Nature* of *nephritic Medicines*.

To examine *Lythonthripticks*, so as to exclude those from that *Class* and *Character*, which have no relative *Vertue* that way : and to lessen the *Catalogue* of those mistaken *specifics*.

To enquire into the *Nature* of the *Hop*, which is so much and perhaps innocently condemned for its aptness to generate the *Stone*.

To explain the manner of the *Operations* of some *Medicines*, which tho they are not *Lythonthripticks* yet may be good *Nephriticks*.

A Postscript to the Publisher, containing a short account of two Human Calculi of unusual form and bigness, from the same F. S. M. D.

SIR,

I Here send you the Figure of a Stone, *Fig. 1.* of a prodigious size and as rare a shape, somewhat resembling indeed the *Kidney*, for that was quite worn away, and this stone fill'd up the place, it weigh'd indeed somewhat more when I took it out of the Body, than it does now, for it then weigh'd seven ounces and a half; there is no *History* that relates any account of a stone generated in the *Kidney*, that does near parallel this. Without breaking it a sunder, I can find it does consist of several *laminae* laid over one another, as that of the *Bladder* does: I took the *Circumference*, and found it to measure seven Inches upon the round.

That taken out of the Body of the late *Duke of Norfolk's* Father, *Fig. 2.* was brought not long since to the *R. Society* by *Sr. Theodore de Vaux*, who gave me leave to send you the Figure of it, which you see is branched, and seems to have spread some branches into great *Vessels*, whether *Arteries*, *Veins* or into the *Ureter* I cannot determine, tho these as well as the *Pelvis* seem to have been fill'd up by this great stone: yet this comes far short of that before mention'd, since it weighs but four ounces and a half: a stone indeed of an incredible size to be found in the *Kidney*. The measure longwise from one extreme to the other made four Inches compleat: the extension of the *Branches* from one to the other measur'd crosswise or transversly, 3 Inches and a half. This is deservedly laid up in the *Repository* of the *Royal Society*, as a great but sorrowful *Rarity*, having caused the death of so great a *Patron* of *Learning*.

An

An account of a Spot seen in the Sun from the 25th. of April to the 8th. of May instant, with the line of its Course predicted, if it make a second Return, by I. F. Astron. Reg.

ON the 25th. of April last past, as I was measuring the distance of the Planet ♀ from the Sun, about an hour before Noon I discovered a large Spot entered within his *diske* a little distant from his following *Limb*. These appearances however frequent in the days of *Scheiner* and *Galileo*, have been so rare of late that this is the only one I have seen in his face since December 1676. Wherefore I thought an account of it might not be unacceptable. By the observed *Meridional* distances of it and the Sun's Southern *Limb* from the *Vertex* at Noon I found it to have 3' 40" more north declination than the Sun's center, and at 3h. 35' after Noon I measured its distance from his next *Limb* 0' 40".

Next morning April 26, I saw it more remote from his *Limb*, and by the Observations then made (at 8 h. mane) determined its Longitude from the Sun's Axis 66 $\frac{1}{2}$ deg. and its declination from the solar Equator 9 $\frac{1}{2}$ d g. South. Whence supposing the Revolution of any point of the Sun to the same fixed Star to be performed in 25 days 6 hours, the Angle of his Equator and our Ecliptick 7 degrees, and the Longitude of his northern Pole $\approx$ 16 deg. I designed the Line of its Way or trace over the Sun and the Points in it where the Spot would appear every morning after at the same hour, till its egress on the 8th. of May, as in the Figure, which I found altogether confirmed by such Observations as I made till then, so that I had no reason to doubt of the Theory.

O

When

When the *Spot* was near the *middle* of the *Sun* it appeared very broad and almost *square*, the *Nucleus* of the same *Figure* about 40" *diameter*, shaped as it is designed in the lower part of the *Scheme*, but when it was near the *Limb* much narrower and almost *Ovall*, it seemed to have *Consistence* enough to endure a *second* return, if it shall it will enter the visible disk of the *Sun* on the 21 of *May* in the evening, and in its passage over him describe a line nearly *streight* with greater latitude from the *Ecliptick*, as I have designed it in the *Figure*, wherein you will see its place every morning at 8 a Clock till its exit the 4th. of *June* about *Sun* rise.

Advertisement.

The *Anachronism* committed in placing this paper in the *Transfaction* of *March* was occasion'd by the necessity of its coming forth early, and there being no room for the *Diagram* belonging to it, in the *Plate* of the following *Transfaction*, which was provided before the arrival of the discourse.

An account of a Polypus found in the heart of a person that died Epileptical, at Oxon. by W. G. M. B. fellow of Wadham Colledge and of the Royal Society.

Several Authors that have been curious to cultivate the *Anatomy of diseas'd Bodies* do so frequently mention *preternatural Concretions* in the heart and blood-vessels especially of persons dead in lingering and *chronical Diseases*, that the present discourse may very well seem *superfluous* to those who are *better* instructed elsewhere. But however, Sir, since you think it worth while to furnish your papers with a thing of this nature, I will not *dispute* the task you have put upon me, and though the *fair Figure* you have bestow'd on the Polypus might *excuse* my farther *description* of the thing it self, yet since it was attended with some *unusual circumstances* not taken notice of by anatomical Writers, which may *conduce* to the determining some doubts and questions concerning the *nature, growth and duration* of such like *concretions*, it cannot be ungrateful a little to enlarge our Observations on the Subject: and that it may be done to the *better purpose* it will not be amiss to premise a description of the *person*, in whom the *Polypus* was found, together with the *Symptoms* he labour'd under, as also an account of other *particulars* that occur'd in the *dissection*, that by considering the *Concomitant Irregularities* in the *other parts of his Body*, whose causes are more *apparent*, we may make more *probable Conjectures* concerning the *occasion and production* of this strange and anomalous substance in his Heart.

Indeed the *person*, whose body was the subject of our Dissection, was a poor labouring man, a meer stranger in the Town, destitute of Relations, and dy'd in the street suddenly, so that there cannot be expected *so particular*

particular a Relation of the Symptoms he labour'd under, as I could wish, or *the thing requires*: but however some things *material* to our purpose, as far as we could learn from the vulgar, who convers'd with him in his Illness, (for he never consulted a Physician,) were such as these, namely; That he was of a *swarthy, lurid* Complexion, and (if we may trust the usual outward Medical Signs) of a *melancholick temper*. The distempers and symptoms, that afflicted him were, Fits of the *falling Sickness*; An obstinate *Quartan Ague* of above a years continuance; A *deep Jaundies*, even to that degree, which is call'd the black, with its constant consequent and universal *settled ill habit of Body*; A sense of an hard load and *pressure at his stomach* (meaning perhaps his *Breast*, or the upper part of the *Region of the Liver*;) he complain'd much of very great *shortness of Breath*, being almost constantly apprehensive of choaking; *far fetcht*, involuntary *Sighings*, and prodigious *palpitations of his Heart* were the continued mischiefs, that attended his miserable life *a great while before death* reliev'd him; he us'd to *swoon* very often; and at length died according to the judgment of the by-standers in the *shivering fit of his Ague*, with the *Convulsions of an Epilepsy*, not without *foaming and frothing* at his mouth; this is all I could credibly inform my self concerning the poor man while living.

As to what was found in the Carcass, three or four Physicians of us having the fair occasion of a Body in private wholly at our own dispose, (which tho' harra'sed with so many Diseases yet was not wasted as to its flesh) did chiefly design a *muscular Dissection*, and so did not direct a very nice particular scrutiny into every part affected, but what was obvious at first sight upon opening the Abdomen and Breast was enough to raise our wonder that the poor fellow could subsist one moment with such Viscera. The *Liver* upon deep Incisions appear'd bloodless, stult
throughout

throughout like a bag of sand with a *yellow gritty substance*, the *Gall-bladder* also was furnish'd with the like, but of a darker hue. The *Spleen* was very large and of too soft and loose a texture, not much discolour'd. The *Omentum* rotten and *wasted*. The Membrane of the *Stomach* extremely flaccid and *very thin*, appearing black and *mortifi'd*, and upon taking it out within twenty four hours after death (tho'ty'd at both ends very close) sent forth such an intollerable *fowr rancid sent*, that the strongest *double Aquafortis* (to which it might best be compar'd) could not prove so troublesome and *offensive* to the smell. The *Lungs* were distended to the uttermost with a *purulent froth*. The *Heart* much stretch'd beyond its natural magnitude and of a very flat figure; the Veins of the whole Body were of an unusual and extraordinary bigness; especial'y the *Internal jugulars* were strain'd to above $\frac{3}{4}$ *Inch diameter*; polypous concretions also were found in the larger veins of the Arms, Legs and other parts, but what most engag'd our attention and wonder was *that which is represented by the 3 Figure*; found in the *right ventricle of the Heart*, and towards its apex or tip *firmly Radicated*, so that no small stress was requir'd for the separation. The part by which it was fixt was nigh an Inch and half diameter when fresh taken out, irregularly rough at the Bottom, *insinuating many Roots into the Lacunæ* or little cavities of the Ventricle, which again by *lesser Fibres* were *fasten'd to the inner Membrane* of the Heart. The *great Branch B.* which ran out into the right Auricle was nigh two Inches diameter at the largest extreme, and reach'd no farther than the insertion of the *Vena Cava*, and whether the current of the blood dashing continually against it, might hinder the progress of its growth, or what other cause I cannot determine, but this I am certain of, that *nothing of the Polypus* extended farther than the figure makes appear, for upon search we could find *no such Concretion in the Vena Cava*. As for those

those Branches mark'd (G. G.) tending to the Arms, how far they grew I cannot assert, not knowing whether they were broke off or no, but the Branches *H. H. H. H.* &c. tending toward the Head (I well remember) could not be *drawn out without some force*, and 'tis very likely they were broke off at the Diverticula or two Round Sinus's where the *Jugulars* enter the Skull; for the like concretions were found in the Vessels of the Brain to which probably these might be adjoyn'd. The substance of the whole was plainly fibrous resembling a Nerve, and *tough while moist* (though upon *drying, brittle*) the colour *white*, and was cloathed with a *thin Coat* including (in that part which fill'd the Right Jugular Vein,) *two little black specks (h. h.) of Blood* (as we suppose) a *long while* there coagulated; as for other circumstances of the *shape, extent, and largeness* of the Polypus the Reader may recur to the *engraven Figure* drawn very near the full dimensions of the thing it self; what has already been said of *it* together with the Remarques on the *whole* dissection will I hope not be altogether unuseful to discover the *Cause and Nature of these strange Bodys* and to determine a Question much debated among learned Physicians *vvhe her a Polypus is produc't some considerable time before or alvvays immediately after death.*

Those that contend for their *sudden generation after death* among other Reasons of *less moment*, insist much on the argument drawn from the tough skin spreading its self in a short time on *Blood let out* for the cure of Pleurifies, Peripneumonies, Rheumatisms, violent headaches, and in cases of any inward Inflammations; It seems a good consequence, that if *Blood could in a Porringer* can so suddenly acquire a kind of a tough thick Membrane on its surface; the *same coldness and want of motion after death* might as easily make the same product in the *Vessels* and 'tis to be confest that such like Concretions have been discover'd in pleuritical Bodys dissected. Yet however

on the other side *in answer* it may be urg'd, that the appearance is not *constant in all* dissections of Bodys so affected, and that very frequently nothing like it has occur'd; from whence we have reason to conjecture, the *outward contact of the Air* pressing the surface of the emitted Blood, or some other *external Cause* may have an interest in *forming that skin*, for else why should not the like concretion proceed constantly in the *Blood-vessels*, whence *Air is excluded* as well as when the blood is *expos'd in a Porringer*. But moreover whoever consults the *Practical Anatomy of Bonetus* on the subject, will find that these pituitous Bodys scarce ever offer themselves in dissection of pleuritical persons but where the *Pleurisy was complicated* with some other *long settled* indisposition; so that the *time of their growth* cannot be certainly collected from such *Instances*; Besides when they do chance to appear in a single Pleurisie, they float loose in the mass of Blood without fixing to any part, are of a very lax texture, without any distinguishable Fibres, and like what covers pleuritical Blood in a porringer do rather resemble a stiffer sort of Jelly or Size almost dry'd, than any thing of a tough and fibrous consistence, such as was observ'd in the *Polypus* now describ'd.

Kerkringius in the 73 of his anatomical Observations, *utterly denies* the existence of any such matter in a living Body, and to confirm his Opinion asserts it in his own power, to make such *Concretions* at pleasure by the known Experiment of *Injecting Spirit of Vitriol* into a dogs veins, and observing the quick coagulation so made inters that some *peccant acid* in the blood occasion'd by a disease, may as suddenly produce the same when life is gone.

In answer to this argument it might be urg'd, (what frequent experience has taught us here in *England*, and what *Kerkringius* himself seems to hint by his own expressions in describing the experiment) that this *artificial* Polypus is only a kind of grumous and strongly concreted blood, wholly different as to colour, texture, and firmness

firmness from that substance which these notes discourse of; but however let us suppose that *Kerkringius* was so lucky, as to produce one exactly like a true *Polypus* in all circumstances, yet it argues not that all these concretions must needs be form'd all on a sudden; it gives indeed some light into the nature of their Cause, but it does not follow that this cause must always work its effect in an *instant*, but a longer or shorter time will be requir'd, as the cause is *more* or *less* active. In the mean time, I do not deny that strange coagulations have suddenly happen'd, and Anatomy has often made such discoveries in cases of sudden death; yet even these generally are not to be lookt on as products after death, but rather the quick inevitable messengers and immediate forerunners of it; such are those concretions that upon dissection have been found in the heart and blood-vessels of persons kill'd by sudden frights, as also in those that have been quickly dispatcht by an unexpected fit of an *Apoplexy*, a *Cardiacal Syncope*, or a *suffocating Catarrh*; where the coagulative Spirit like lightning strikes through the whole mass of blood, and either *fixes* it and makes it unapt for the generation of fresh Spirits, or else, if a gross similitude may illustrate so abstruse a matter, (like what happens to the invisible steams of Spirit of Salt Armoniac, which will be *condens'd*, grow turbid and visible at the approach of the vapour of Spirit of Salt or Nitre) the animal Spirits themselves are *clouded*, alter'd from their natures, extinguish'd and quite destroy'd by a *mixture* of the foreign preternatural halitus. 'Tis not improbable that by one or both of these methods the *pestilential* Effluvia of an infected Air, the *Arsenical* Exhalation of a damp, and the *nitro-sulphureous* steam (much like the scent of Spirit of Nitre) arising from burning charcoal do often act such *sudden* and fatal Tragedies. For if we reflect on the *membranous* substance of the Lungs, the infinite number of *Vesicles* they are compos'd

of,

of, how that in every *assignable* point these vesicles are adorn'd with capillary blood-vessels, so that the point of a needle every where draws blood; if we calculate the *inward Concave* superficies of the Lungs, supposed unfolded and spread out into a plain, which must needs exceed the *outward apparent Convex* above an hundred times, and consequently consider the vast surface of Blood each moment expos'd to the Air: Lastly, if we allow the *Ingress* of the Air into the Blood upon breathing, which scarce any now deny, I say if we reflect on these things, 'tis easie to imagine how suddenly mischievous any *coagulative* poysonous steam may prove, since together with the Air 'twill be diffus'd through all the Blood contain'd in the Lungs at the *very Instant* of Inspiration, and, (whether it be *austere* or acid or both, or what other name Physicians may please to give it) joyns it self *per minima* with almost each particle of Blood, and (as steams of hot lead (they say) fix Quicksilver into a solid) presently destroys all *Fluidity*, stuffs the Lungs and Heart with an *immoveable* and almost mortifi'd Mass; puts a final stop to the Circulation, and so in a moment breaks off the Series and Thred of Life.

The *Concretions* that have such surprizing events we must allow to be *suddenly* produc't; and we may ascribe all perhaps to the exceeding *briskness* and activity of the *acid*, or what other quality gave their origine, but nevertheless in the case of *lingring Diseases*, I think it will be no hard matter to prove, (not to contend that they differ from those already mention'd) that at least they make a slower progress in their growth as proceeding from a less active cause, and considering the nature and consistence of the bodies themselves, the Diseases and Symptoms that usually accompany them, and the circumstances of those Dissections that have discover'd them, they must needs appear a *work* of time, and by a *daily* apposition of *new* parts swell into that *strange Bulk* and *shape* they sometimes obtain.

What *Consistence* these Bodies sometimes acquire, this above describ'd is a very instructive instance. The close fibrous texture, the tough Membrane that cover'd it, and the two black hard specks therein included, its strong adhesion to the heart by little capillary Roots and other larger protuberances adapted to all the little cavities of the Ventricle, are *arguments* that it was no small time in growing: and if it happen'd after death, how came it to pass that the large branch *B.* should *stop* within the Auricle, and that nothing of the *like substance* should be *continued* farther into the *Vena Cava*, since the Blood there must needs be as much dispos'd to such a sudden coagulation as in the heart; but it will be easie to account for this circumstance if we lay the first Rudiments in the heart, allow them to *grow* by a *daily* apposition of fresh parts, and that growth constantly to be *circumscrib'd* by the Appulse of Blood, or by the action and *labour* of the Auricle, wherein this branch so oddly shap'd was contain'd. Lastly, if to these remarques we add the Instance *Malpighius* gives of a Polypus made *hollow* by the current of the Blood, like another new blood-vessel fram'd with the natural one; If also we add another round one *Borellus* speaks of, bigger than a mans fist, found in the *Aorta* near the heart, consisting of a great many membranes lying unconnect one upon another, like the leaves of a Cabbage, (*a product (without doubt) of no small time*) we need go no farther than the *bare accidents* of these odd *bodies themselves* to prove their long continuance before death.

At least what usually offers in *dissecting* bodies thus affected, so *demonstrates* the thing, as to leave no place for doubt, and not to heap up Quotations and many Histories of what others have found, the *present subject* (I think) brings evidence enough in the point. For here we have the Jugular Veins (whose coat could not have been much stretcht on a *sudden*, even by the wind of a Smith's Bellows) in *tract of time*, enlarg'd only by the gentle assiduous

duous pressings of the blood, to *thrice* their former diameter, that is, *nine times* their natural cavity. Here we have a heart, (*the strongest and firmest Muscle of the Body*) by degrees form'd into a shape quite different from the natural; the right Auricle and Ventricle notwithstanding the strength of the Fibres of *the latter* and their indisposedness to stretch easily, so prodigiously distended, that no outward force whatever without breaking it could effect the like; such hard shift did nature make to continue the vital stream and avoid the fatal stop, *each moment* threatned by the Polypus, that with *double* force she was oblig'd to maintain a Pulse, which (because it could not break or expel the unnatural load,) did By *little and lit le stretch* the sides of the ventricle, for the more easy passage of the blood, and by terrible palpitations for *a long time* protract a miserable life, till the monstrous body growing too big, the weakened Fibres could stretch no more, nor yet regularly contract themselves any longer; so that the Heart at last just ready to sink under the burden, is forced to collect its little remaining strength into one brisk effort, and assisted by *all the spirits* of the Body caus'd the poor wretch to expire in an universal Convulsion.

After this Instance, it might be improper to add the more uncertain arguments drawn from *the Diseases and Symptoms* that are either the *Effects* or *Causes* of *Polypi*, but that the bare mention of such distempers does not only (as being generally chronical) farther prove their duration, but also illustrate their *natures* and suggest a cure (if possible) or at least a method of *prevention*. The *Diseases* wherein almost always they may be expected, are the Apoplexy, Phrensy, falling Sickness, Convulsions, Asthma (or difficult breathing,) Consumption, ill cur'd and lingering Feavers, Plague, venereal Diseases, Pleurisies, Peripneumonies, Green-Sickness, varices of the Veins, and inveterate Headaches, &c Instances in all which and many more *Bonetus* has industriously collected out of *Plagerus Wepfer, Severinus, Tulpius, Blasius, Ballonius, Ker-*

kringius, Borellus, Malpighius, and others, too many to be nicely quoted; since we have among us in the University, eye witnesses enough in most of the cases recited.

The part most usually affected is the right Ventricle of the heart, and *the genus venosum*, where the blood returning from the habit of body, flow in motion, impoverished and dispirited more easily admits such a concretion: yet the left Ventricle and the *genus arteriosum* frequently breed the like, such was that *Tulpius* mentions, branching out into the *Aorta* and *Vena Pulmonaris*, in a person who died of a grievous Apoplexy, and such *Wepfer* makes one great cause of Apoplexies. The sinus's of the brain also often harbour them, as we have found in one that had an obstinate Headach, and at last died mad; and not long since in another, who once had some fits of a Frenzy, and at length died epileptical, in both which cases the *sinus longitudinalis* was full of a *Polypus*, which emitted very tough branches into all the little lateral vessels, and *Blasius* gives the like account in a mad-Man's brain, who at last died convulsit. 'Twere easy to amass together many Observations of this nature, but upon the streis of these already brought tis reasonable to assert, that a *Polypus* is so far from being a product at the period of a disease, that it seems rather a stated settled cause as well as an immediate occasion of the fatal symptoms which attend the most incurable distempers; thus if in the heart it grow so large as to force a *Diafbole* beyond the due tension of the *Fibres*, it produces a mortal *Syncope*; if smaller and not exceeding the confines of the Ventricle, a strong and irregular pulse succeeds, and there must be a palpitacion of the Heart to maintain life; if it send branches into the larger pulmonary vessels, the motion of the blood is retarded, and the breast and lungs labour under their load in an *Asthma*: or if it reaches the capillaries, a *Peripneumony*, an *Ulcer*, and at last a *Consumption* is at hand; if the concretion begins in the small vessels of the *Pleura*, then a *Pleurisy* follows, if it grows and fixes in the larger vessels of the arms, legs, or the like, painful *varices* appear, and probably *Rheumatisms* owe much of their pain to some such concretions begun in the capillary vessels of the habit of the Body. Again, when these bodies are in the *Sinus of the Brain*, if small, the vessels will only be a little distended, and so a *pain in the head* may suffice, but if larger, the obstruction increases, the blood and spirits are cast into an hurry, the brain is inflam'd, the senses presently are disorder'd in the apprehension of their objects and so a *Frenzy* seizes the man; if yet they chance to be bigger and fill the *Sinus* more, the blood pent up, moves more furiously, and so destroys Sense and all voluntary functions,

Elions, then the tumult extends beyond the limits of the *brain* through the whole systeme of the *Spirits*, and whereas in a *Frenzy*, *Sense*, though mistaken did direct their paths, now they run *quadata porta* ungovern'd and impetuous through the *Nerves* and *Muscles* causing the *involuntary motions and Convulsions* of an *Epilepsy*, which continue till the *Spirits* are spent, the *blood* quiet, and the *blood-vessels* by the *very agony* enlarg'd equal to their burden; and indeed in *Epilepsies*, dissections seldom miss of a *Polypus*, neither can we deny this convulsive power of a concretion in the *brain*, since the great *Lower's* experiment tells us that a *Dog* died in terrible *Convulsions* by injected *Milk* coagulated only in his *heart*; but lastly, if the *Sinus* prove almost totally obstructed, the *blood* instantly overflows the *brain*, and without much previous notice (except perhaps of giddiness, loss of sight, or the like) an *Apoplexy* insues; which disease will also more dangerously happen, when some particles of a *Polypus* in the left ventricle of the *heart* broken off by the violent stream of *blood*, shall be impacted into the *carotid Arteries* at their insertion into the *brain*, whence all intercourse of *spirits* will irrecoverably be stoppt. Now tho in some of these cases a *Polypus* does only by fits disquiet the man it possesses, yet it is in being when it does not produce such sensible effects, for exercise, passions, diet and other external causes will so affect the quantity and motion of the *blood*, that the obstruction may be more insupportable than when the stream was calm, and tis as easie to imagine the disorders thus caus'd in an *animal body*, as that a large swift *River* dam'd up from quietly pursuing its own channel, must needs impetuously overflow all the country about; and thus we have consider'd those *Symptoms* of which a *Polypus* may rationally be thought (at least occasionally) the next and immediate cause. As for others before mention'd, namely, the *Plague*, *venereal Diseases*, *lingring Fevers*, and the like, they are not the effects of a *Polypus* but causes that dispose the *blood* of some Persons to such pituitous Concretions.

But to discover their cause more nicely we may observe with *Wefer*, that persons thus afflicted are never well, *breath* hardly, have frequent palpitations of the *heart*, unequal pulses, are dull to all action, stupid, luxurious and slothful, of a livid leaden or sallow Complexion or a saturated red in hands and face, because there is either very little *blood* in the *Capillaries* of their *skin*, or at best a slow circulation; their *blood* has usually a thickness and peculiar lentor in it, or abundance of *serum*, the later for want of *volatile salt* to digest the *chyle* into a laudable red, and the former Happens, either because the *heart*, destitute of *spirits* for its pulse, cannot duly agitate the mass, or (as experiments on *blood* emitted seem to prove) by reason of the mixture of a preternatural *Acid*, whence may infer this conjunct

cause

cause of a *Polypus*, that the Fibres of the *blood* not being sufficiently sustain'd and kept asunder by a due motion of the intercepted fluid parts, may either barely upon the account by *Rest* cling together, or else may be by degrees connected to an *austere astringent acid* (always to be found in cachectical Bodies) for the same reason as (an *analogous liquor*) milk is curdled, only with this difference that in this, the coagulation is brittle, because the Fibres are weak and short, whereas it may be very tough in *blood*, because its Fibres are strong and of a greater length.

Upon the whole we may conclude that whatever maintains the fluidity, motion, spirit, and texture of the *blood* promises a cure (though not of a confirm'd *Polypus*) yet of the first Rudiments of it. All these indications are answer'd by medicines of volatile, brisk active parts, which destroy acids, exalt and ferment the *blood*, and do not only hinder, but also dissolve the first beginnings of coagulation and probably tis by affecting the *blood* and not immediately the *nerves*, that they do such feats in diseases before mention'd. Lastly, the effects of bleeding in some cases can never enough be admir'd, thus *Riverius* tells us of a Girl 12 years old, being bled plentifully for a *Fleurisy*, was cur'd of her falling Sickness, a disease never without the suspicion of a *Polypus*.

But Sir, the importunity and surprize of the Press must put a stop to these Speculations, and gives me leave only to beg yours and the readers favor for all the defaults of

Your humble Servant

W. Gould.

The explication of the Figure of the *Polypus* according as it appear'd, when fresh expanded on a Board.

- A. That part of the *Polypus* which was firmly rooted in the right Ventricle of the Heart.
- B. The Branch terminated in the right Auricle.
- C. D. D. D. The part tending toward the Lungs.
- E. E. The Branch running out of the ventricle into the pulmonary Artery.
- e.e.e.e. &c. The several lesser Ramifications distributed according to the several divisions of the pulmonary Artery.
- F. F. F. The branch belonging to the descending Vena Cava.
- G. G. The branches began in the Axillary veins.
- H. H. H. H. &c. The two branches that ran up the Internal Jugulars even to their entrance into the Skull.
- h. h. Two little black specks of concreted blood contain'd within the Coat of the *Polypus*.

An account of a Book, viz. The Geometrical Key, or Construction of all Equations Linear, Quadratic, Cubic and Biquadratic, by a Circle and one only Parabole; by Mr. Tho. Baker Rector of Bishop Nympton in Devonshire.

The *Analysis* which the *Ancients* used for the constructing *Problems* geometrically or by lines, has been highly advanced by *des Cartes's* method; that part of this method which concerns local *Problems* has been well explained by *de Wit*, but the other and more principal part of constructing *Equations* has been lately cleared by *de la Hire*. Yet neither *des Cartes* nor *de la Hire* do it without the trouble of preparing the *Equation* by taking away the *second Term*. To free us of this trouble our *Author* here shews us to construct all affected *Equations* not exceeding the 4th power, by the *Intersection* of a *Circle* and *Parabola* without omission or change of any *terms*. And altho by the *Method* of *des Cartes* we may find not only any *Parabola*, but also *Ellipses* and *Hyperbolas* to construct these *Equations*, yet of all lines of the first kind a *Circle* and *Parabola* being the most simple, it follows that the way which our *Author* has chosen is the best.

In the *Book* (to render it intelligible even to those who have read no *Conics*) the *Author* shews, how a *Parabola* arises from the *Section* of a *Cone*, then how to describe it *in plano*, and from that construction demonstrates that the *squares* of the *Ordinates* are one to another as the correspondent *Sagittæ* or intercepted *Diameters*; then he shews that if a line be inscrib'd in a *Parabola* perpendicular to any *Diameter*, a *Rectangle* made of the *Segments* of the *Inscript*, will be equal to a rectangle made of the intercepted *Diameter* and *Parameter* of the *Axis*. From this last propriety our *Author* deduces the universality of his *central Rule* for the *Solution* of all *Biquadratic* and *cubic Equations*, however affected or varied

varied in *terms* or *signs*. After the *Synthesis* our *Author* shews the *analysis* or *method* by which he found this Rule, viz. a *Parabola* being described, and a *point* in its *plain* given in *position*, he expresses 2 ways, the *radius* of a *Circle* passing through the *Vertex* of any *diameter*, i. e. by *position* of the given *Center*, and application of the foresaid *propriety* to express the *ratio* of the *radius* to the given lines of the *parabola*: So having an *Equation* of 4 *dimensions*, and rejecting equal on both sides, he depresses it to a *Cubic*, but adjoyning to it a quantity for the *Homogene* of the comparison, the *Equation* subsists in a *Biquadratic*, having all its *terms*, if the *Circle* be supposed to pass not thro the *vertex* of the *diameter*, but thro a *point* which being joyn'd with the *Vertex* and *Center* may terminate a right angled triangle.

This *Equation* he compares with another like it and equal to it; then by *equating* the *Coefficients* of these 2 *Equations* he presently discovers the *central Rule*; whose universal extent appears in *Biquadratic Equations* affected under all their *Parodic* degrees; for all the other *cases* where any *terms* are wanting, are but *Corollarys* or more compendious *Constructions* deriv'd from the general rule. So that the invention of the *rule* seems as much due to the last *Equation* of the *Coefficients*, as to the foresaid *propriety*, which is demonstrated by *Archimedes* in the *Section* of a *parabolic Conoid* by a *plane* parallel to the *axis*, and is particularly used by *Slusius* in his *Analytiks*, who thereby constructs a *Biquadratic Equation* keeping all its *terms*. But then the *Analysis* of *Slusius* by breaking the *Equation* into 2 others to find 2 *places* is very different from that whereby our *Author* found his *central rule*; then which nothing can be expected more easie, simple, or universal; seeing any *Parabola* being once for all described, will give all the roots true and false, of any *Equation* without reduction or any alteration.

ERRATUM. p. 518. line the last, read Nubigenum.

O X F O R D, Printed at the THEATER, and are to be sold by Moses Pitt, at the Angel, and Samuel Smith, at the Princes Arms in St. Paul's Church-yard LONDON. 1684.



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Fig. 1.

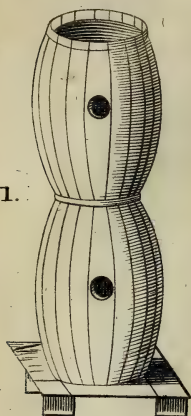


Fig. 2.

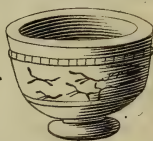


Fig. 4.

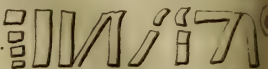


Fig. 3.



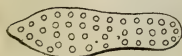
Fig. 5.



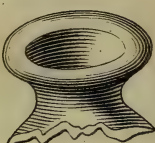
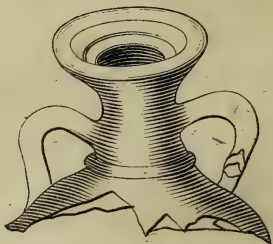
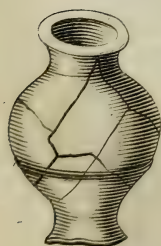
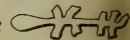
a



b



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MBurghers sculp.

PHILOSOPHICAL TRANSACTIONS.

April 20. 1684.

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24 hours

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A Letter from the learned and ingenious Mr. Will. Molyneux Secretary to the Society of Dublin, to Will. Musgrave L. L. B. Fellow of New Colledge, and Secretary to the Philosophical Society of Oxford, for advancement of natural Knowledge ; concerning Lough Neagh in Ireland, and its petrifying Qualitys.

SIR,

IN Answer to the Oxford Society's Query concerning our Lough Neagh and its Petrifying Qualitys, I make this return.

1. That it is generally agreed by all the *Inhabitants* thereabouts, that it has that *Quality*, but yet I have a Letter by me from a *Gentleman* (unknown to me, and therefore I will not promise for his Credit or the Fidelity of his enquiry) that that positively denies that there is any such thing, but asserts that the *Stones*, that are brought to us as *petrify'd Wood*, are found deep in *Sand Hills* in the *Country* adjoyning to the *Lough*, alledging as an experiment, that a *Gentleman* of his Acquaintance, stuck an *Oak Stake* into the *Lough* twenty years ago, which there remains unalter'd. But I conceive this Assertion to be without ground, and the experiment's falsly made ; For first 'tis agreed by all that no *Wood* will *Petrifie* in this *Lough*, except *Holly*, so that his applying an *Oak Stake* was improper ; Secondly, for their being found in *Sand Hills*, they may easily be supposed in process of time to have been brought thither, and left there : for I do not find he asserts that they are found so deep in those *Hills* that have not been dug up ; and thirdly, it is with some probability asserted (and I have a Letter from an understanding *Person* thereabouts confirming it) that the *Earth* about *Lough Neagh* has this *Petrifying Quality*, and we may well imagine that these *sand Hills* especially, are not destitute thereof ;

For

For I am certainly informed, that a *Gentleman* of the *Country* about this *Lough* a little before the *Rebellion* cut down some *Timber* for building, and amongst others cut down a large *Holly Tree*, but being diverted by the *Rebellion* from building, his *Timber* lay on the ground in the place where it was fell'd, upon the banks of the *Lough*, all the miserable time of the *War*; till at last, the *Kingdom* being settled, the *Gentleman* went to look for his *Timber*, and found the other *Timber* overgrown with moss, and the *Holly* petrified, tho the *Water* of the *Lough* had never reach'd it.

2. I Query whether the *Holly* it self, that grows upon the *Banks* of this *Lough*, may not be more apt to be petrify'd, then the same wood growing other where, and brought thither, and put into the *Lough*, for certainly if the ground has this *Quality*, this is very likely to follow.

3. That what we call *Lough Neagh stone* was once *Wood*, is most probable on these accounts, first it will not stir with *Acids*, which is a property observed by Dr. Grew on some petrify'd *Woods*, in the *Musæum R. S.* p. 270. tho the Dr. does there make it an Argument for his suspecting they are *Lapides sui generis*. Secondly, the *Lough Neagh stone* will burn and flame; and the smoak of it smells like the smoak of wood. Thirdly, when burnt it betrays the very *Grain* of *Wood*, with the other vessels belonging to *Vegetables*. But that which confirms me above all, that these *Stones* were once *Wood* is, because I have many of them by me of various *Degrees* of *Petrification*, I suppose according to the time they remained in the *Water*, which I could never hear justly determin'd; some that have clearly lost the colour of *Wood*, and are become perfectly black, and very hard; others that are not so black nor hard; But one more especially was sent me about a year ago, which is a *Parallelepiped* of about four Inches long and an Inch thick, cut I suppose whilst *Wood* into that shape purposely, whose outward coat is very black and smooth, but this is meerly superficial, for being cleft longwise through the middle (which it suffer'd far more easily then that which is more throughly petrified) I there discovered the whole body perfectly of the colour and grain of *Holly*, for I can scrape it with my nail; but what was most surprizing in it was the discovery of the *Pith*, as plainly and as perfectly distinct in colour and texture from the rest (but it also was Petrify'd) as it could possibly have been seen in the natural *Wood*; That this piece when wood was cut in-

to this shape on purpose to try the *Experiment*, I am induced to believe on these accounts, first no *Tree* grows in the shape of a *Parallelepiped*; and that this is not a *Stone* appears from the inward texture, differing so much from the outward coat, and from the smoothness of the outward coat, and ruffness inwardly, which smoothness could never be induced since it was a *Stone*, for if you grind it, so as in the least to wear off the outward black coat, the rough white inside shews it self immediately.

4. What the Learned Physician *Anselm Boetius* asserts in his *Historia lapidum & Gemmarum* is certainly false, viz. That that part of the *Wood* that is buried in the *Mud* will become *Iron*, that part touch'd by the *Water* becomes *Stone*, and that above the *Water* remains *Wood*, for I never have seen or could hear of any part of the *Stone* in the least resembling *Iron*.

5. I have used some endeavours to procure a piece of this *Lough Neagh stone* to which the *Wood* was yet fast'ned, but I never could attain it, tho some assert they have seen pieces 2 or 3 foot long with about 8 or 10 inches of *stone* and the rest *Wood*. Tho I am apt to believe this may be stretching the matter too far, for I conceive that that *Humour* that *Petrifies* one part, when it begins to operate, insinuates it self soon throughout the whole body.

6. 'Tis observed that this petrifying *Quality* is not equally diffused throughout the whole *Lough* (which is about 15 or 16 miles long, and 8 or 9 miles broad in all places) but is most strong about that part where the *black Water* (a *River* so call'd) empty's it self into this *Lough*, that is about the *Southwest Corner*; as likewise 'tis said to be more strong about the *Edges* of the *Lough*, then further into the *Water*.

7. It was queried a while ago by an Ingenious and Learned Member of the *Royal S. Mr. Hally*, whether *Lough Neagh stone* were not *Magnetical*, for he was told it was; but upon tryal I find it is not, for it will not stir a *Needle*, or *Steel filings*, neither will it apply to the *Magnet*, in powder or calcined.

This is all that offers it self at present relating to the Query of the *Oxford Society*, if any thing more occur, they shall be informed thereof by

Their most Obliged

Humble Servant

William Molyneux.

A Letter

*A Letter from Mr. Thomas Machel of Kirkbythore
in Westmorland to Sr. W. D. March 25, 1684.
concerning some Antiquities found there.*

YOur love to *Antiquity*, and my Obligations to you are such, that I cannot omit to give you an Account of a strange *Well*, discovered here about a week since by the foot of an *Horse*, which stumbled upon it ; and therefore may be called the Fountain *Hypocrene*.

'Tis in the Street of *Kirkbythore* by the Bridge-end, on the North side of the River *Trout-Beeck*, the Antient Boundary twixt the Lordship of *Crackanthorpe* (my Brothers Estate) and this of *Kirkbythore*, and is about ten yards distant from it, in the common Road ; and as many yards distant from the great *Roman Causey*, which leads to *Carlisle*, and goes betwixt it, and a place called the *Burwens*, being part of the Ruines of *Whelp-Castle*, on the East side of it : And 'tis very strange that a *Well* should be digged so near to the *River*, unless perhaps the *Castle-walls* have gone betwixt them, and the way run through it ; as at *Maiden-Castle*, on the top of *Stanemore*.

It hath been covered with a Plank of wood about nine inches thick, in the fashion of a *Portlid* : but decayed and macerated to the colour and consistence of a *Peat* or *Turfe* ; infomuch, that I could hardly conjecture what wood it was made of; but I suppose *Oake*. And above this was gravel and pavement about a yard thick, which (being tendered by the late great *Frost* and swelling of the Spring) easily gave way to the *Horses* foot.

Instead of *Walls*, were two large wooden *Vessels*, one upon another, like *Hogsheads*, or *Wine-pipe*, with *Bung-holes* in them, about three inches *Diameter* : and the plowings for the heads were fair to be seen. They were made of *Fir* (whencesoever they came) above an inch thick ; each of them in depth, by a *Perpendicular*, 6 foot at the least, at the *Head*, in circumference no less then 8 foot, being in *Diameter* 2 foot and 8 inches : and in the middle 10 foot and 4 inches, being in *Diameter* no less then 3 foot 5 inches and $\frac{1}{2}$. The wood was found, but withal very spongy by reason of the water.

At the bottom about 5 yards deep, were 4 Planks of wood laid *quadrangular* wise, supported with a stone at every Corner, to bear up the *Fabric*, and let in water through the
gravel

gravel and sand, which lay loose in the bottom about a yard deeper, as was tryed by a Spit, and these also found (though the Cover was rotten) because not so much exposed to the Air.

The men that searched it, having my permission, (for it lies on my side of the high way) flattered themselves with great hopes of some *Treasure*, when they saw the appearance of a *Hoghead* set on end: and their expectation was therefore the stronger, because they could not possibly imagine that a *Well* should be placed in an *open Street*, in a *publick high way*, and so near to the *River*: but they only found *Fabritian Plate*; old earthen-Vessels, with pieces of *Urnes*, one piece of a *drinking Glass*, and several *Sandals*, which may serve to bespeak the *Antiquity* of it, for sure 'tis long since any *Sandals* were worn in this *Country*.

The earthen-Vessels were of very fine Metal (if I may so call it) of a *Brick like* colour, and in several *Forms*; But the most (and most remarkable) were, like a *Basin* or *Possel-Cup*, the Bowl, *semiglobular*; the foot, a *Ring*: some were in *Diameter* about 8 inches, and in depth on the inside, more then $3\frac{1}{2}$, some more, some less, as appeared by the *Fragments* which came to my hand. They were (for the most part) very finely imbossed, but three more especially, viz. 1. One with a *Vine branch*, having a *Figure* in every turning, and in the first place a *naked Man* standing alone upon his left foot, the other leg cross, and holding his left hand down towards his back, his right towards his belly, with a branch of *Lawrel* of 3 sprigs in it, one of which turns up to his face-wards over the crooke or bending of his *Arm*; and at his feet is a *Branch* of *Lawrel* and a *Blossom* or *Flower*: In the next is a *Vine-leaf*, 2 *Blossoms* at the bottom; and at the top 2 *Peacocks* regardant: In the next is *Victory* (as I take it) viz. an *Angel* or *Genius* holding in its right hand (the *Arm* stretched out, and the face looking towards the *Man*) a *Garland* of *Lawrel*; in the left, a *Sprig* of the same; and two sprigs likewise are at the foot with *Flowers* or *Blossoms*, and one *Flower* in the middle betwixt the *Garland* and one of those *Sprigs*. In the next is a *Vine-leaf* the same as before, in the next is *Victory*, and so by turns, till it ends with a *Vine-leaf* next the *Man*. And upon it are also some *Goth like Characters* of the lesser sort, but dim and obscure. Another of these *Pots* is adorned with *Circles* and *Semicircles*, in one of these *Circles* is the *Figure* of a *Man*, sitting on a *Plinth* or square stone; in all the rest are fluttering *Genii*. In some of the

Semicircles are *Lions* and *Goats* (or some such like *Creatures*) here one, there another ; all single and current : and near the bottom, are *Stags* in *Course* and *Gray-hounds* pursuing, with an *Inscription* (in a *Goth* like *Character* of the greater sort) which see Fig. 4. This may be *Paulini*. An *Inscription* with the like *Characters*, is to be seen at *Burrowbrigg* and published by *Dr. Lister*. And they have been careful in preserving these ; for this and some other, having been broke, are crammed (or rather soldered) with lead.

3. The third sort, is yet far more beautiful then any of the rest, being adorned with *Gray-hounds* very well moulded, and in full pursuite of *Stags* and *Hinds*, and the *Wild Boar* ; upon which I discovered the same *Inscription*, as in the other. And tho I am not so vain, as to say this relates to our *Coats of Arms*, yet having so near an *Affinity* with it, both in *Crest* and *Charge* ; (*a.* the *Stags* head, *b.* 3. *Gray hounds* current. *c.* *Whelp Castle*) and being found at the place which we came from (as is said and believed) I cannot but take some notice of it ; and have sent you a piece to look upon, which will (without doubt) give you more satisfaction both for the matter and colour of it, then any *Description* in writing can do. But I desire you to return it again.

There were several other broken *Inscriptions*; and one above the rest upon the bottom of a plane *Dish* or *Platter* (on the inside of it) writ in this manner, Fig. 5. But whether it stands for *Vespasian* *Imperator* or *Domitianus*, or neither of them, I cannot tell.

As to the *Glass*, there was but a very small fragment of it, I can scarce guess the *Figure*, but I think it a flute *Glass* made like a *Tunnel* or *Spire* inverfed. But this is remarkable, that it hath been as thick as a *Barly-Corn*.

The *Urns* were of a leaden colour inclining to black ; one had been large, 2 inches thick in the side of the *Pot*, but how big I know not, for there was a sherd only brought to me like half of a *Shield* : I have now the top also, being in *Diameter* from outside to outside 7 inches, of which the *Koll* is 2 inches and the *Mouth* 3 inches. The *Neck* yet streighter, and only thick there, one third of an inch. The *Figure* of which you have. And many such are found at this *Town*, some of which have *Ears* or *Handles* as thick as my *Arm-wrist*, and their *Heads* and *Mouths* much of this bigness, but thicker and stronger, such as that Fig. 6. into which I could not thrust in my hand. But the other was almost intire and whole, tho a very small
one

One ; in depth or height $8\frac{1}{2}$ inches, the *Diameter* of it $6\frac{1}{2}$ inches which is in *Circumference*, $19\frac{1}{2}$ wide ; in the *Mouth* almost $3\frac{1}{2}$ in the *Neck* somewhat more then $2\frac{1}{2}$; by the *Diameter* : the bottom well nigh as big as the top, excepting the *Ring* ; and the *Body* in thickness the fifth part of an inch : but thicker somewhat at the top and the bottom.

But the *Sandals* were most admired by me, because I never saw any before. There were some for *Men*, some for *Women*, and some for *Children* ; all shap'd by their feet, spreading more to the outside then to the inside : and some were very large and some very crooked as this in the Cut. The leather was fresh, of which they were made, but very tender when it came to be spread upon a Last. Each consisted of three principal parts ; an upper leather (or rather heel piece with 2 *Tab*s on each side) an inner Soal, long $11\frac{1}{2}$ inches, broad $3\frac{3}{4}$; of 3 or 4 Soals stitched together with leathern thongs, and an outer Soal^b of 2, stuck full of *Nails* with little round heads (so decayed and rotten that I could scarce discern them to be *Iron*) plated on the inside : And to the upper leather (3 fold in the heel piece^c) is fixed betwixt them and sowed with leather, or rather tacked, which the *Iron Nails* do help to defend. Yet I think some *Womens* (of the better sort) had no *Nails* at all^d. And of these there is one well worth the *Observation*, of *Spanish-like* leather and curious workmanship, being exactly stitch'd down round about the fore piece long $2\frac{1}{3}$ inches with a pretty *Label*^e of the same piece, hanging from it, for fashion sake surely ; since 'tis too slender to be of any use. As small in the string as the *15^b* part of an inch. The *Tongue* at the end broad half an inch, long one inch, betwixt the two flourishes, which is the length of the small string, 8 parts in 10 of an inch, the two flourishes take up the rest^f. The Figure of which you may see.^g

When I first discovered *them*, I thought peradventure, that the people here, in former times might have worn such *Shoes*, as they do in *Ireland*, and the *High lands* of *Scotland*, which they call *Broagues* : and that these might be such ; but having the opportunity of discoursing an *Heblander* that travelled by, while we were digging : and another *Gentleman* the very next day, who had travelled those *Countrys* ; I was fully satisfied that they were not *Broagues* ; for those (they say) have but one single Soal, and these have six, And so I leave them and the whole matter to your Consideration, &c.

An abstract of a Letter from the worshipful John Evelyn Esq; sent to one of the Secretaries of the R. Society concerning the damage done to his Gardens by the preceding Winter.

SIR,

I should be altogether inexcusable for not having been to wait upon the Society of late, if my health had permitted, with some other unexpected occasions (before I remov'd from *Lond.*) which I could not decently avoid: This was I assure you, a sensible Affliction to me, and now I am come into the Country, have beheld the havock which a rude season has made in my poor Gardens, and receiv'd your Letter, wherein you acquaint me that the Society expects an Account of my sufferings, I must begin with the Poet, ——— *Jubes renovare dolorem*: In a word, the past Winter has been so severe in my Territories, and where it could expugne the more defensible, and such as were inclosed, it has ravag'd all that lay open, and were abroad, without any mercy.

As to Timber Trees. I have not many here of any considerable age or stature, except a few *Elms*, which (having been decaying many years) one cannot well find to have receiv'd any fresh wounds distinguishable from old cracks and hollownesses; and indeed I am told by divers, that *Elms* have not suffer'd, as the great *Oaks* have done; nor do I find amongst innumerable of that Species (*Elms*) which I have planted, and that are now about 25 and 30 years standing, any of them touch'd: The same I observe of *Limes*, *Wall-nuts*, *Ash*, *Beech*, *Horn-beams*, *Birch*, *Chestnut* and other foresters: But as I said mine are young comparatively, and yet one would think, that should less protect them, be aise more tender: so as it seems the rising so much complain'd of, has happen'd chiefly among the over-grown Trees, especially *Oaks*: my Lord *Weymouth* made his Lamentation to me, and so has the Earl of *Chesterfield*, Lord *Ferrers*, Sr. *William Fermor* and others concern'd in the same Calamity, which I mention, because of their distant habitations. But if rightly I remember, one of these Noble Persons lately told me, that since the Thaw, the Trees which were exceedingly split, were come together and

and clos'd again, and I easily believ'd it; but that they are really as solid as before, I doubt will not appear, when they shall come to be examin'd by the Axe, and converted to use: Nor has this accident happen'd only to standing Timber, but to that which has been fell'd and season'd, as Mr. *Skish*, the Master Builder in his Majesties Ship yard here, inform'd me: so much for our *Indigenæ*. As for *Exotics*, I fear my *Cork-trees* will hardly recover; but the Spring is yet so very backward (even in this warm and dry spot of mine) that I cannot pronounce any thing positively; especially of such, whose bark is very thick and rugged, such as is the *Cork*, *Enzina*, and divers of the resinous Trees. The *Constantinopolitan* or *Horse-Chestnut* is turgid with buds, and ready to explain its leaf. My *Cedars* I think are lost: The *Ilex* and scarlet Oak not so; The *Arbutus* doubtful, and so are *Bays*, but some will escape, and most of them repullulate and spring afresh if cut down near the Earth, at the latter end of the month: The *Scotch Fir*, *Spruce*, and white *Spanish* (which last uses to suffer in their tender buds by the spring frosts) have receiv'd no damage this Winter; I cannot say the same of the *Pine* which bears the greater Cone, but other *Norways* and *Pinasters* are fresh: *Laurel* is only discolour'd, and some of the woody branches mortified, which being cut to the quick will soon put forth again, it being a succulent Plant. Amongst our Shrubs, *Rosemary* is intirely lost, and to my great sorrow; because I had not only beautiful hedges of it, but sufficient to afford me flowers for the making a very considerable quantity of the Queen of *Hungaries* celebrated Water: so universal (I fear) is the destruction of this excellent Plant (not only over *England*, but our neighbour Countries more Southward) that we must raise our next hopes from the Seed. *Salinus* or Sea Pursellan (of which I had a pretty hedge) is also perish'd, and so another of French *Furzes*; the *Cypress* are all of them scorch'd, and some to death, especially such as were kept shorn in Pyramids; but amongst great numbers, there will divers escape, after they are well chastiz'd, that is, with a tough hazel or other wand to beat off their dead and dusty leaves, which growing much closer than other shrubs, hinder the air and dews from refreshing the interior parts. This discipline I use to all my tonfile shrubs with good success as oft as a winter parches them. The berry bearing *Savine* (which if well understood and cultivated were the only best *succedaneum*

to *Cypress*) has not suffered in the least ; it perfectly resembles the *Cypress* and grows very tall and thick. I think the *Arbor Thuya* is alive, and so is the *American Acacia*, *Acanthus*, *Palinurus*, *Pomgranad* ; my *Laurustinus* looks suspiciously ; some large and old *Alaternus*'s are kill'd, especially such as were more expos'd to the Sun, whereas those that grow in the shade escape ; the reason of which I conjecture to be from the reciprocations of being somewhat relax'd every day, and then made rigid and stiff again all night, which bending, and unbending so often, opening and closing the parts, does exceedingly mortifie them, and all other tender Plants, which growing in shady places undergo but one Thaw and change. Most of these yet will revive again at the root, being cut close to ground : The *Phillyreas angustif*, and *Serratifolios* (both of them incomparably the best for ornamental hedges of any the perennial greens I know) have hardly been sensible of the least impression, more then tarnishing of their leaves, no more have the Spanish *Jasmines*, and *Persian*, and I enumerate these particulars the more minutely, that Gentlemen who are curious, may take notice what *Plants* they may trust to abroad, in all Events ; for I speak only of such as are expos'd : As for the choiser Rarities which are set in for hyemation, they certainly escape, or are impair'd, accordingly as they are treated by the more, or less experienc'd and industrious Gardner, or commodiousness of the Conservatory ; but to say what may be added on this Subject, would require a large Chapter, not a Letter, I would in the mean time, advise such as have suffer'd detriment in their green Houses, not to despair, when they see the leaves of of their *Myrtles*, *Oranges*, *Oleanders*, *Jasmines* and other precious Shrubs, russet or altogether shrivell'd and falling ; but to cut them to the quick, plaster the wounds, and plunge their cases and pots (trim'd with fresh mould, &c.) in a warm bed, carefully refresh'd, shaded, air'd and treated as sick patients, and as the prudent Gardner best knows how. But above all, that he be sure, not to expose them, till these Eastern Winds (which I call our English *Etesians*, and which makes our Springs so uncomfortable, when we think Winter and all danger past) be qualified ; for they are deadly to all our Plants abroad, and frequently do us more prejudice than the most churlish Winters ; as commonly finishing the destruction of what the frosts have spar'd, nor are we to be flatter'd with a warm day or

two, which are apt to tempt Gardners to set out their Plants, before the end of *April*, or that we find the wise *Mulberry* put forth ; which is certainly the most faithful monitor ; nor should we indeed, cut, or transplant any of the *Perennials* 'till of themselves they begin to sprout.

I need say nothing of of *Holly*, *Tew*, *Box*, *Juniper*, &c. (hardy and spontaneous to our Country) and yet to my grief again, I find an holly standard of near 100 years old, drooping, and of doubtful aspect ; and a very beautiful hedge (tho indeed much younger) being clip'd about Michaelmas, is mortified near a foot beneath the top, and in some places to the very ground ; so as there's nothing seems proof against such a Winter ; which is late cut, and expos'd. This hedge does also grow against the South, and is very russet, whilst the contrary side is as fresh and green as ever ; and in all other places of my Plantations that are shaded, the unshorn *Hollies* maintain their verdure, and are I judge impregnable against all assaults of Weather.

Among the fruit Trees, and Murals, none seem to have suffer'd save *Figs* ; but they being cut down, will spring again at the root. The *Vines* have escap'd ; and of the esculent Plants and Salads most, except *Artichokes*, which are universally lost ; and (what I prefer before any Salad whatever eaten raw, when young) my *Sampier* is all rotted to the very root : how to repair my loss, I know not, for I could never make any of the seed, which came from the rock *Sampire* (tho mine were of the very kind) to grow.

The arboresecent and other *Sedums*, *Aloes*, &c. (tho hous'd) perish'd with me ; but the *Yucca*, and *Opuntia* escap'd. Tulips many are lost, and so the *Constantinople Narcissus*, and such *Tuberoseæ* as were not kept in the chimney corner where was continual fire : some *Anemonies* appear, but I believe many are rotted ; but I have made no great search in the flowery *Parterr*, only I find that most capillaries spring, and other humble, and repent Plants notwithstanding all this rigorous season.

My *Tortoise* (which by his constant burying himself in the Earth at approach of Winter I look upon as a kind of *Plant-Animal*) hapning to be obstructed by a Vine-root, from mining to the depth, he was usually wont to interr, is found stark dead, after having many years escaped the severest Winter. Of *Fish* I have lost very few ; and the *Nightingals* (which

(which for being a short wing'd Bird, and so exceeding fat, at the time of the year, we commonly suppose them to change the Climate, (whereas indeed they are then hardly able to flee an hundred yards) are as brisk and frolic as ever, nor do I think they alter their summer stations, whatever become of them all Winter. I know not yet of any body, who has given tolerable satisfaction in this particular, amongst our *Ornithologists*.

Thus *Sr.* I have sent you a Rhapsody of such Observations as I have been able to make since my return home, and I wish they may prove of any importance to the Society, to which, and to your self, I am

Sir,

Says Court Depford

April 14, 1684.

A most devoted

and Obedient Servant

Accon-

A conjecture about an under-Current at the Streights-Mouth, read before the Oxford Society, Dec. 21. 1683. by the reverend and learned Tho. Smith D. D. Fellow of Mag.Col. Oxon. and of the R. Society.

IN the *Offing* between the North Foreland and South Foreland it runs *Tide and half Tide*, that is it is either *ebbing water* or *flood* upon the shore, in that part of the *Downs*, three hours, which is grossly speaking the time of *half a tide*, before it is so, off at *sea*. (For the *flux* and *reflux* of the *sea* is not made exactly twice in 24 hours, but, as it appears by accurate observation, it requires an overplus of almost 50 minutes.) The reason of this diversity of *tides*, I take to be from the meeting of the two *seas* in that narrow *streight*.

Oftentimes when the *wind* has blown hard at N.E. or at W. or W. and by S. there has hapn'd an alteration of the *tides* in the river of *Thames*, which ignorant people have mistakingly lookt upon as a *prodigy*.

It is a most certain *Observation*, that where it flows *tide* and *half tide*, tho the *tide* of *flood* runs aloft, yet the *tide* of *ebb* runs under foot, that is, close by the ground; and so at the *tide* of *ebb*, it will flow under foot, as that great and experienc'd Sea-Commander, * Sr. Henry Mainwaring words it. Upon this supposition I shall humbly offer a *conjecture* to this learned Society concerning the *mediterranean Sea*, after I have premised this brief *history* of it, as containing certain matter of fact.

There is a vast draught of water poured continually out of the *Atlantick* into the *Mediterranean*, the mouth or entrance of which between Cape *Spartel* or *Sprat*, as the *sea-men* call it, and Cape *Trafalgar*, may be near 7 leagues wide, the *current* setting strong into it, and not loosing its force till it runs as far as *Malaga*, which is about 20 leagues within the *Streights*. By the benefit of this *Current*, tho the *wind* be contrary, if it does not over-blow, *Ships* easily turn into the *gulf*, as they term the narrow *passage*, which is about 20 miles in length. At the end of which are two *Towns*, *Gibraltar* on the

coast of *Spain*, which gives denomination to the *Streight*, and *Ceuta* on the *Barbary* coast: at which places *Hercules* is supposed to have set up his *Pillars*. What becomes of this great quantity of water poured in this way, and of that, which runs from the *Euxine* into the *Bosporus* and *Propontis*, and is carried at last through the *Hellepont* into the *Agean* or *Archipelago*, is a curious speculation, and has exercised the wit and understanding of *Philosophers* and *Navigators*. For there is no sensible rising of the water all along the *Barbary Coast*, even down to *Alexandria*, the land beyond *Tripoli*, and that of *Egypt*, lying very low, and easily overflowable. They observe indeed, that the water rises 3 feet, or 3 feet and an half, in the gulph of *Venice*, and as much, or very near as much, all along the *Riviera* of *Genoua*, as far as the river *Arno*: but this rather adds to the wonder.

I here omit to speak at large of the several hypotheses, which have been invented to solve this difficulty: such as *subterraneous vents*, cavitys and indraughts, *exhalations* by the *Sun beams*, the running out of the water on the *African side*, as if there were a kind of circular motion of the water, and that it only flowed in upon the *Christian shore*: which latter I look upon as a meer fancy, and contrary to all observation.

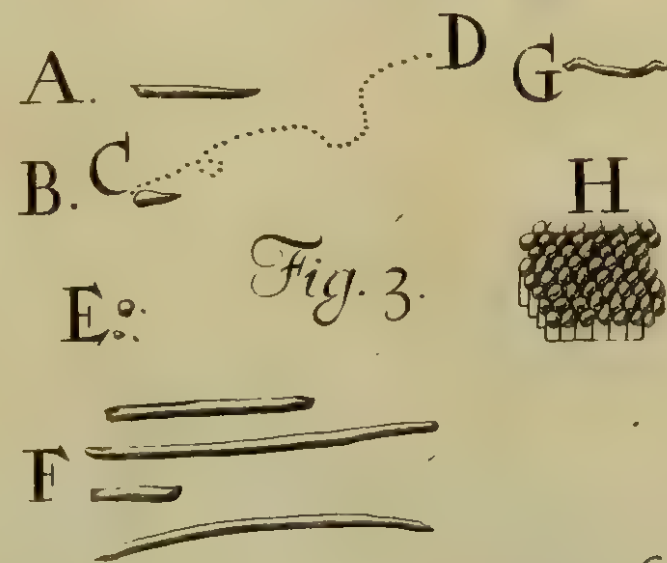
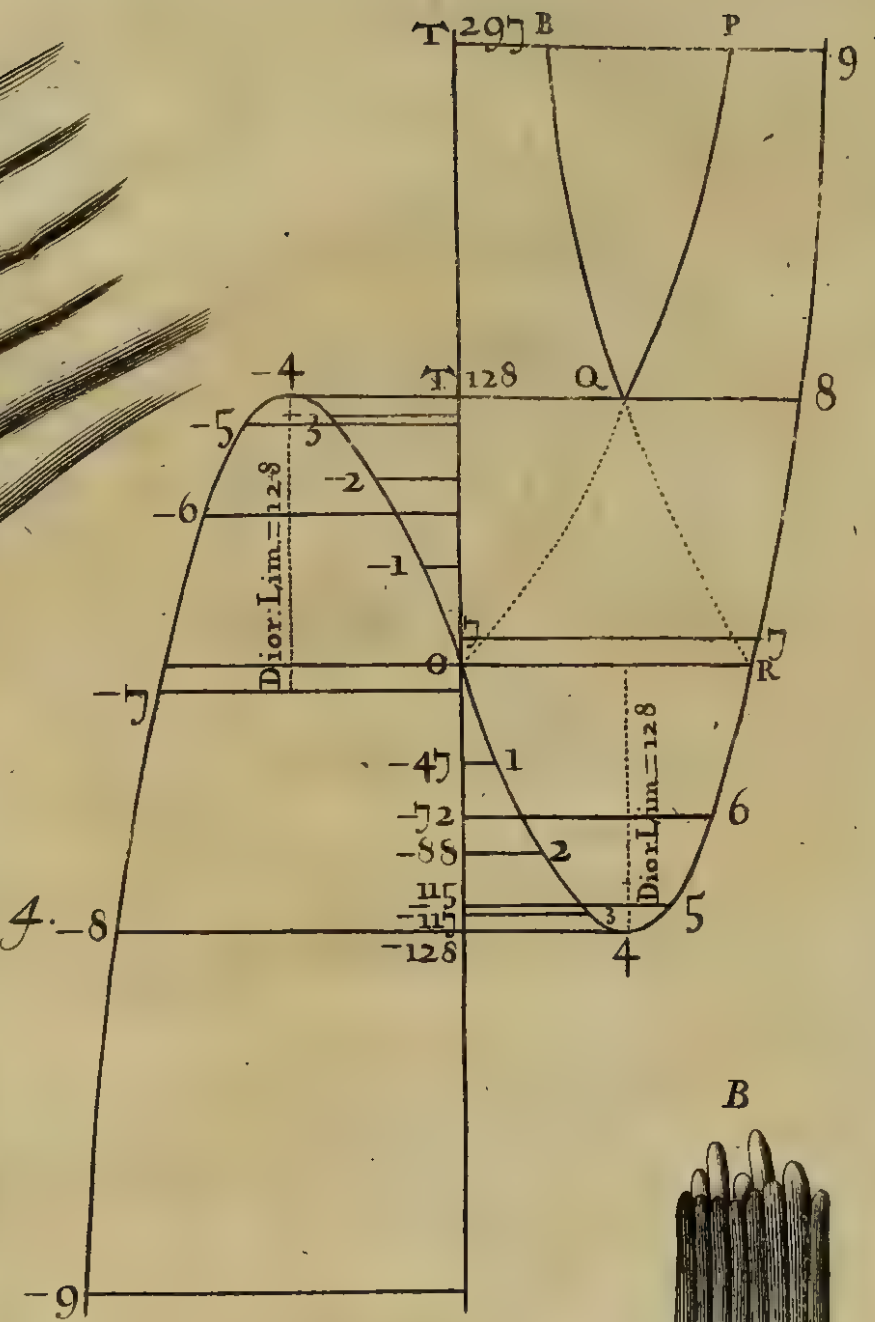
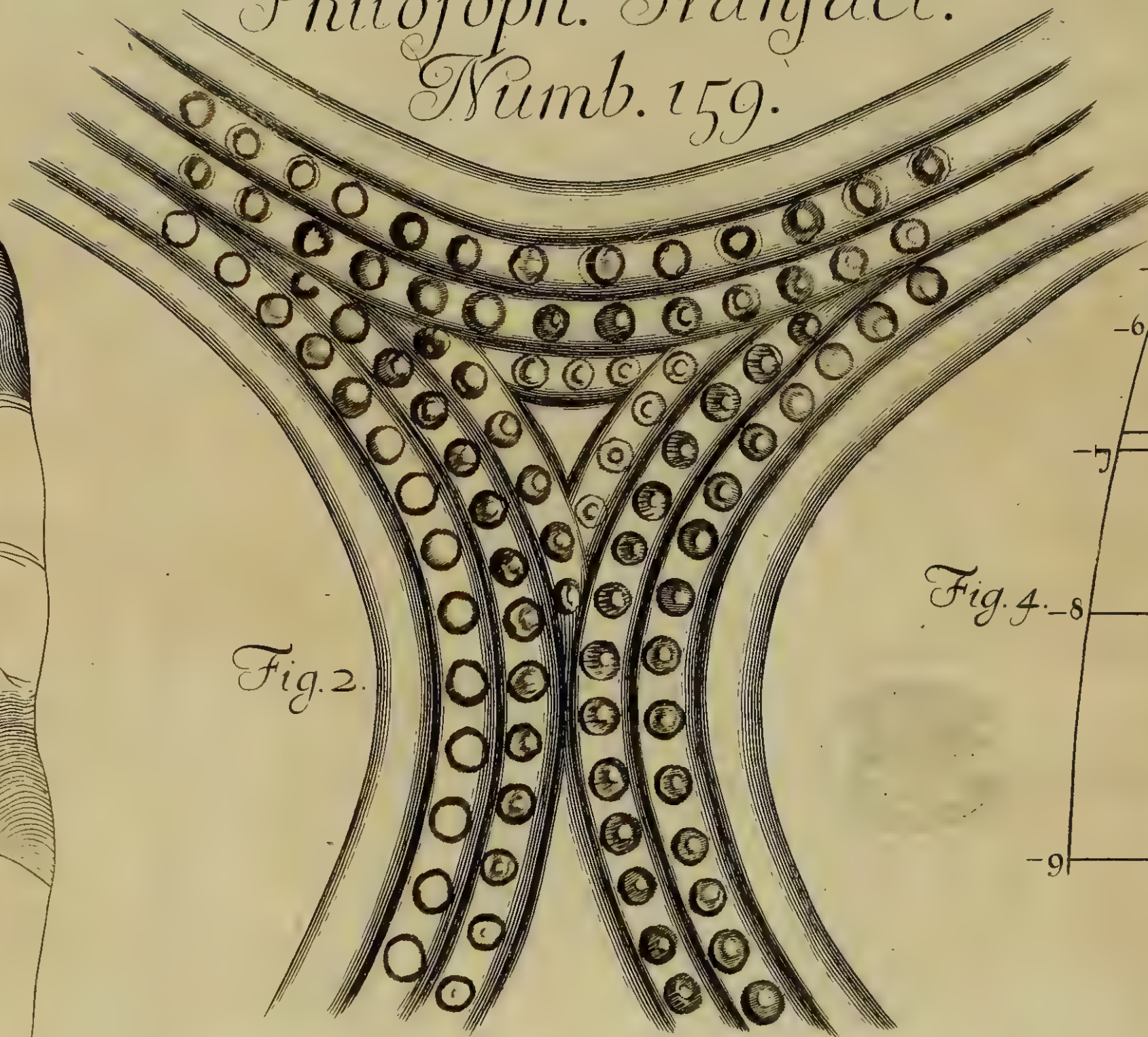
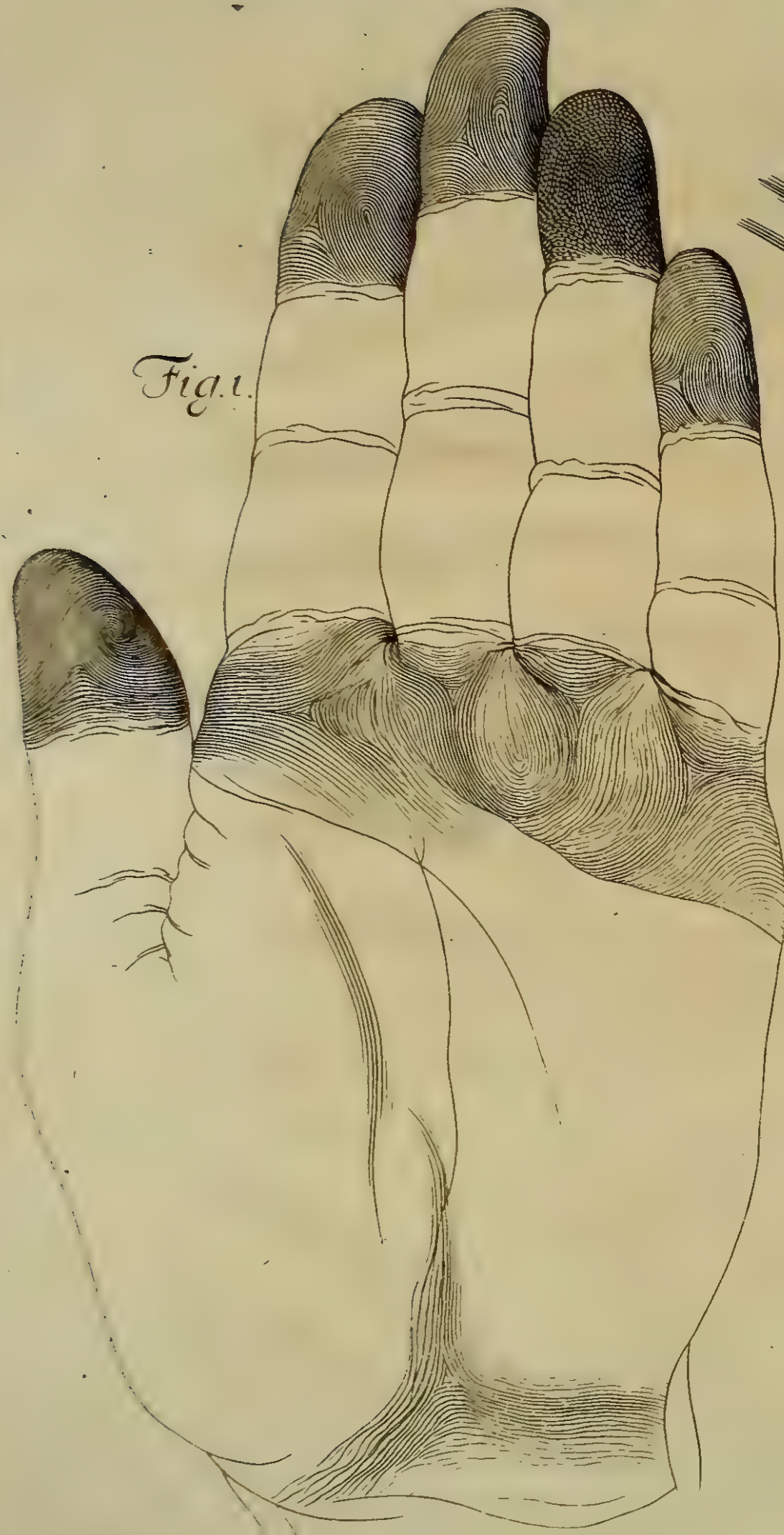
My conjecture is, that there is an *under-current*, whereby as great a quantity of water is carried out, as comes flowing in. To confirm which, besides what I have said above about the difference of tides in the *offing*, and at the *Shore* in the *Downs*, which necessarily supposes an *under Current*, I shall present you with an instance of the like nature in the *Baltick Sound*, as I received it from an able seaman, who was at the making of the tryal.

He told me, that being there in one of the *King's Fregats*, they went with their *Pinnace* into the *middle stream*, and were carried violently by the *Current*: that soon after they sank a bucket with a large *Cannon* bullet to a certain depth of water, which gave check to the boats motion, and sinking it still lower and lower, the boat was driven a head to wind-ward against the upper *Current*: the current aloft, as he added, not being above 4 or 5 fathom deep, and that the lower the bucket was let fall, they found the *under-Current* the stronger. I designed

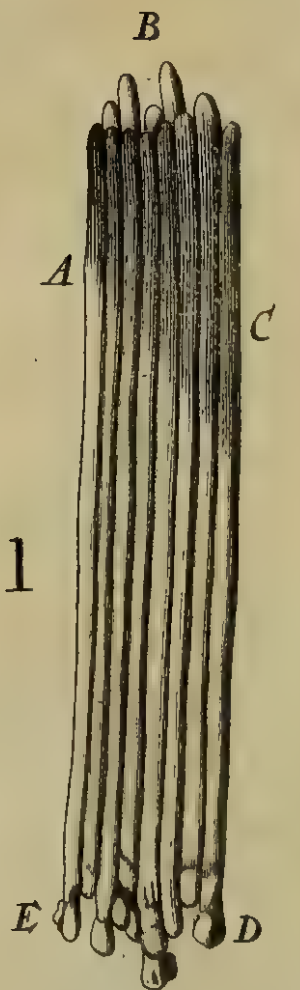
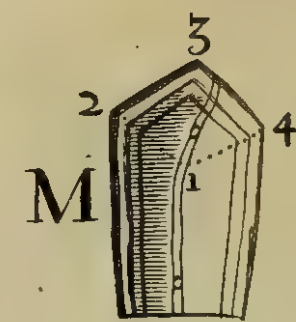
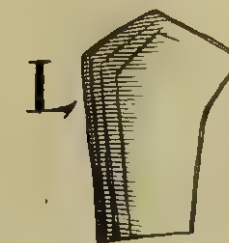
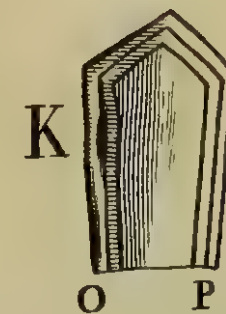
designed to have made the *Experiment* in the *Streights-Channel*; but both times I past, the Easterly wind blew so hard, that there was no putting out the boat with any safety; nor indeed at those times had we any leisure for such a *Curiosity*; which those, who lived at *Tanger*, might have tried without any difficulty or danger.

This conjecture, how likely or unlikely soever, will stand or fall according to the certainty of the *Observations*, which shall be made there, which I will endeavour to procure in order to the further establishment, or utter overthrow of it.





M. Burg. sculp.



PHILOSOPHICAL

TRANSACTIONS.

May 20. 1684.

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1. *Two remarkable Cases relating to Vision, communicated to the Publisher, by the learned and ingenious Wil. Briggs M. D. fellow of the College of Physicians, and Physician of St. Thomas's Hospital, Lond.*

Sr. **I** Received some time since an account of a remarkable Case in *Vision*, from Dr. Peter Parham a worthy Physician in *Normich*; which because it so rarely occurs,

X

and

and the like is mention'd but by few Authors, I imagin'd that the *following Transcript* of two Letters he was pleas'd to send me about it, might not be unwelcom to you, and therefore I took this opportunity of conveying it to your hands.

First Let. 'I was lately in *Suffolk*, and there met with a 'pretty odd but curious case relating to Vision; which 'I thought then had something of *Rarity*, and continue 'still in the perswasion. A *Gentleman* gave me the History 'of it, and because his Servant, who was concerned in 'it, was then in the house, I had the opportunity fully to 'inform my self, and if there be any Questions you would 'have propos'd, I shall shortly see him again.

'The *Gentleman* propounded the *Case* himself, to know 'the Philosophy of it, and what should be that particu- 'lar *Figure* in his Servants *Eye*, that he should see so a- 'cutely and strenuously in the *day*, and be just like a post 'so soon as the *Sun* set. The young man may be towards '20 years of age, and all the day hath as good a sight, if 'not better, than any of the family; distinguisheth at as 'great a distance any object; sees either nigh at hand or 'far off, or any of the intermediate spaces as well as any 'body, and with as much vigour and unweariedness; but 'when twilight once comes, is (as the Proverb says) 'blind as a Beetle; sees nothing; runs against Gates, 'Posts or Rails (any thing either higher, lower, or level 'to his Eye) and cannot without great difficulty direct 'himself. Neither is all this from the want of any vi- 'gorous influence from the Rays of the Sun, as I conceive; 'for when he is at home and in the house, he tumbles o- 'ver Stools, runs his head against Doors, and cannot 'see or direct himself tolerably well either by the greater 'or lesser lights of the fire and candle; but commits 'pleasant mistakes, is apt to complement your feet as 'readily as present you steadily with a glass of Wine, 'runs his head against his Master's foot when he is to pull
'off

‘ off his Boots, and gives them some other diversions after-
 ‘ ward about the Fire and Utensils there, which cau-
 ‘ seth variety of sometimes pity and other whiles
 ‘ laughter.

‘ I confess this odd and unusual case rais’d my curiosity
 ‘ to view the Boy well and to discourse with him; there
 ‘ is no disease in the Organ that can be observ’d; no *Ver-*
 ‘ *tigo* or distemper in the head to interrupt or any way
 ‘ intercept the Spirits in their motions, but to all appear-
 ‘ ance the fabrick of the Organ is very true and exactly
 ‘ well, and never disturbed with *fluxes* any way.

‘ I did observe the Eye both by day and night, but
 ‘ could not find fault with any part; neither do I think
 ‘ the suspicion well grounded, that he sees better than
 ‘ others by day-light, because of the vigour and plenty of
 ‘ Rays, for then he might have the same benefit from good
 ‘ fires and candles to invigorate the Organ, and contract
 ‘ the Pupil (for so I suppose it is done, because the greater
 ‘ the Sun-shine is, the better those generally see that are
 ‘ short-sighted) but it seems rather to depend on some of
 ‘ the *Humours*, tho I can’t tell at present on which, ha-
 ‘ ving not had time since to consider of it. I try’d him
 ‘ with Spectacles for variety of sight, but they did him
 ‘ no service by either lights.

Second Let. ‘ I have had a further account of that odd
 ‘ case I acquainted you with in my last. and also receiv’d
 ‘ a Resolution of those Questions you propounded, which
 ‘ I now send you: I have ranged the problems in the or-
 ‘ der they were sent me.

Qu. 1. ‘ Whether the person was so from a child, or any
 ‘ observable occasion? R. He was thus from the first time
 ‘ he was able to take notice of things, and it came without
 ‘ Distempers.

2. ‘ Whether any cloudiness at night falls gradually
 ‘ upon him like a Mist, or all at once when Sun sets? To

‘which he replies, that it comes gradually upon him as day-light declines.

3. ‘What effect the several Aspects of the moon have upon him? He says none, for he is always alike.

4. ‘Whether he feels any pain by fire or candle-light? he says not any.

5. ‘Whether worse in the winter than summer? To which he says, he hath not observ’d any difference.

6. ‘Whether upon taking cold he be worse? he says, he never observ’d any mischief by cold.

7. Whether he sweats much at any labour, and so grows worse upon any sudden stopping of the pores toward night? R. He sweats much at work, but finds no inconvenience, neither observes any difference as to his sight in those days when he works hard or not.

‘So that if you take this account as a true and plain Narrative without any artifice, it may be judg’d very rare, and is the first case I ever knew of the like kind. I rest, &c.

Thus far the diligent Observer in his account of this unusual case, which I forbear giving you my thoughts upon at present, reserving them for another occasion; and this being so extraordinary an indisposition of the Eye, it may very well deserve a more particular consideration in the *Pathology of that part*, which I formerly intimated my intentions one day of publishing. And now I have the *opportunities* of making more frequent Observations in the *Distempers of that part*, which I then thought requisite to so great a design (and which were since put into my hands, by the exceeding bounty and favor of his most Gracious MAJESTY, as I must ever own, when he was pleas’d of late to place me in the care of one of his *Hospitals* here) I think my self in a double manner oblig’d to prosecute a subject, which may be of so great importance to the world. and should gladly receive any account relating to it.

The case now mention’d (though indeed in a different sense

sense from that of *a. Hippocrates*) is call'd by later Writers *Nyctalopia* or *Nocturna Cæcitas*, and is accordingly described; with the *Remedies* for it, by *b. Galen*, *c. Pliny*, *d. Forestus*, *e. Sennertus*, and *f. Joel*; to whom I refer the Reader. *Cornelius Celsus*, (*de Medicin. lib. 6. cap. 6. §. 38.*) mentions it under the title of *Imbecilitas oculorum*; but none of all these have given so exact and full a history of it as will be found in the foregoing Relation.

2. To this unusual case I shall subjoyn, another relating to the same subject, which I lately had the opportunity of observing here in *St. Thomas's Hospital*, together with my worthy friend *Dr. William Dawkins* (whom I have the happiness to be joyn'd with there) in a Patient we had for some time under our hands.

The case was this; *Daniel Wright* aged about 19 years, of a sanguine and plethoric Constitution, about the end of the year 1683. was seiz'd with a dizziness and pain in the upper part of the head, which he told me he could impute to nothing but the excessive cold weather, which then raged with us to extremity. Hereupon having the misfortune to apply himself to an ignorant Pretender to *Physick* here, a Plaister for his head was on'y order'd at that time (without any evacuations) but whether it was the *Empl. cephalicum cum euphorbio* in the Dispens. or any other I could not learn. The Patient upon this grows much worse, the pains of his head more fixt and girding (I suppose from some Spasms or constrictive Motions of the *Meninges*) to which succeeded convulsive Fits (which were accompanied afterwards with a Tremor upon his Arms and Legs) and upon this all Objects appear'd double to him, from the fibres of the optic nerves being thus distorted from their wonted Parallelism. After this poor young man had been thus tortured by his *Empirick*, and this Distemper for about 3

a In Porrbet. lib. 2. §. 40. b See Galende Ocul. Part 6. cap. 10. c Plin. nat. hist. lib. 8. cap. 50. d Forest. lib. 11. observ. 38. e Sennert. lib. 1 part. 3. sect. 2. cap. 44. f Joel practic. lib. 2. Sect. 1. §. 10.

months, he was taken in as a great Object of charity into our *Hospital*. Upon his admission I examined his case as particularly as I could, and judg'd (by his *seeing all things double thus*) that the *Optic Nerves* were affected, and that it was gone so far that it would probably end in a *gutta serena*, and accordingly it fell out not long after his being in the *Hospital*; which confirms me in the *Opinion about Vision* I formerly communicated to the *R. Society*.^c

In this difficult and extraordinary case, where the Patient had been so long afflicted, and the Fits grew daily worse upon him (so that he had several in a day, which he told me made his Life so uneasy, that he did not care what was done with him) we endeavour'd by all ways we could to relieve him. Accordingly we order'd the *Cephalic Pills*, and an *Electuary* (which we use in the *Hospital* in *Epileptic Cases*) which he receiv'd much benefit by: he was also (by intervals) bled in the *Jugulars* and in the *Hæmorrhoids* and by *Leeches* which also gave him good relief; his head was shaved, blisters apply'd to his Neck, and a *Seton* made sometime after, &c. we endeavouring by all manner of *Revulsions* to derive the humour another way, if it were possible; but it was too much fix'd, and of too long standing, so that about two months after he had been under our care (and now and then not without some prospect of Relief) a *Gutta Serena* seiz'd on his right Eye, that he could not see at all on that side; but then the *duplicity* ceas'd and he saw all Objects single again as before, which is another confirmation of the fore-mention'd Opinion.

In the mean time the left Eye being still in danger, we further order'd (besides the continuance of the former *Electuary*) a *Fontanel* about the meeting of the *Sagittal* and *Lambdoid Sutures*, and Cupping-glasses to his Neck and Shoulders, that nothing might be left unat-

tempted that we thought requisite ; but it seems these last were omitted, and whilst we were thus solicitous about preserving his t'other Eye a severe Fit seiz'd him, soon after which he died. I hapned the day after to be with a Patient out o'th town, and not having timely notice of his death I mist the opportunity of opening the Body ; but I was told that in the upper part of his head, neck and shoulders, a *great blackn /s* appear'd not long after he was dead (from the settling of the blood I suppose in those parts) which shews that what was last order'd, which was for several days before his death, had been very proper in this case.

What success the *Trepan* or *Salivation* might have had here we did not try; tho the former where there is any discharge of matter, and the latter in *venereal pains* of the head I know succeed well ; but these were not chiefly *nocturnal*, and the Patient (whenever I prest him in the thing) protest to me the contrary, and seeing him so willing to do any thing for a Cure, and being a very sober temperate Youth, I had no reason to suspect him ; and indeed he never suffer'd much of those severe and *girding pains* but when his Fits were upon him.

Thus, Sir, have I sent you a plain Narrative of this extraordinary Case, hoping you will excuse the careless and un-studied dress 'tis sent in ; whereby you will further oblige

SIR,

Your very humble Servant

William Briggs.

The

The description and use of the Pores in the skin of the hands and feet, by the learned and ingenious Nehemiah Grew, M. D. fellowv of the College of Physicians and of the Royal Society.

BY *Pores*, *Physicians* mean no more, than certain permeable spaces between the parts of a Body. Wherefore, that there are *Pores* in the skin of every man's Body, is no more to be question'd, than whether Men do ever sweat or perspire.

But in the *Hands* and *Feet*, they are very remarkable ; both in respect of their *Position* and their *Amplitude*, hitherto, so far as I know, describ'd by no *Anatomist*.

For if any one will but take the pains, with an indifferent *Glass*, to survey the *Palm* of his *Hand* very well washed with a *Ball* ; he may perceive (besides those great *Lines* to which some men have given Names, and those of a middle size call'd the *Grain* of the skin) innumerable little *Ridges*, of equal bigness and distance, and every where running parallel one with another. And especially, upon the ends and first Joynts of the *Fingers* and *Thumb*, upon the top of the *Ball*, and near the root of the *Thumb* a little above the *Wrist*. In all which places, they are very regularly disposed into *spherical Triangles*, and *Ellipticks* ; as in the *Hand* I have caused to be drawn *Fig. 1.* Upon these *Ridges* stand the *Pores*, all in even *Rows*, and of that magnitude, as to be visible to a very good Eye without a *Glass*. But being viewed with one, every Pore looks like a little *Fountain*, and the sweat may be seen to stand therein, as clear as rock water, and as often as it is wiped off, to spring up within them again.

That which *Nature* intends in the position of these *Ridges*, is, That they may the better suit with the use and

and motion of the Hand: those of the lower side of every *Triangle*, to the bending in or clutching of the Fingers; and those of the other two sides, and of the *Ellipticks*, to the pressure of the Hand or Fingers ends against any body, requiring them to yield to the right and left. Upon these *Ridges*, the *Pores* are very providently placed, and not in the *Furrows* which lie between them; that so their structure might be the more sturdy, and less liable to be depraved by compression; whereby only the *Furrows* are dilated or contracted, the *Ridges* constantly maintaining themselves, and so the *Pores* unalter'd. And for the same reason, the *Pores* are also very large, that they may still be the better preserved, tho the skin be never so much compressed and condens'd, by the constant use and labour of the Hand. And so those of the *Feet*, notwithstanding the compression of the skin by the weight of the whole Body.

These *Pores* being thus made and secur'd, are a very convenient and open passage for the discharge of the more noxious and perspirable parts of the *Blood*. Which by the continual use of the *Hands* and *Feet*, are plentifully brought into them. Whence it is, that the sweat of the *Feet*, in many people, is much more offensive than that of any other part of the *Body*. And that many *Hypochondriacal* Men, and *Hysterical* Women, have almost a continual burning in the soles of their *Feet*, and the *Palms* of their *Hands*. Yet not on the top of their *Feet* or back of their *Hands*; which being not so much chafed nor kept so warm, are the less disposed to receive the said noxious parts; and are therefore unfurnished with this kind of *Pores*.

An abstract of a Letter from Mr. Anthony Leevvenhoeck at Delft, dated Sep. 17. 1683. containing some Microscopical Observations, about Animals in the scurf of the Teeth, the substance call'd Worms in the Nose, the Cuticula consisting of Scales.

I Formerly sent some Observations about Spittle, which I find have been Printed in the Lectures and Collections of Mr. R. H. in the year 1678. Since that time I have often observed my Spittle, out of this Consideration, that if there be any Animals dispersed in our Body, they may at some time or other, be emptied out of the *Ductus Salivales* into the Mouth. But my expectation in this particular has fail'd, for I have perceived no Animals, or other thing in Spittle than what I formerly mentioned.

Tho my Teeth are kept usually very clean, nevertheless when I view them in a Magnifying Glass, I find growing between them a little white matter as thick as wetted flower: in this substance tho I could not perceive any motion, I judg'd there might probably be living Creatures.

I therefore took some of this flower and mixt it either with pure rain water wherein were no Animals; or else with some of my Spittle (having no Air bubbles to cause a motion in it) and then to my great surprize perceived that the aforesaid matter contained very many small living Animals, which moved themselves very extravagantly. the biggest sort had the shape of *A*. their motion was strong and nimble, and they darted themselves thro the water or spittle, as a Jack or Pike does thro the water. These were generally not many in number. The

2d. sort

2d. fort had the shape of *B.* these spun about like a Top, and took a course sometimes on one side, as is shown at *G.* and *D.* they were more in number than the first. In the 3d. fort I could not well distinguish the Figure, for sometimes it seem'd to be an Oval, and other times a Circle. These were so small that they seem'd no bigger than *E.* and therewithal so swift, that I can compare them to nothing better than a swarm of Flies or Gnats, flying and turning among one another in a small space. Of this sort I believe there might be many thousands in a quantity of water no bigger than a sand, tho the flower were but the 9th. part of the water or spittle containing it.

Besides these Animals there were a great quantity of streaks or threds of different lengths, but like thickness, lying confusedly together, some bent, and others streight as at *F.* These had no motion or life in them, for I well observed them, having formerly seen live-Animals in water of the same figure.

I observed the Spittle of two several women, whose Teeth were kept clean, and there were no Animals in the spittle; but the meal between the teeth, being mixt with water, (as before) I found the Animals above described, as also the long particles.

The Spittle of a Child of 8 years old had no living Creatures in it, but the meal between the Teeth, had a great many of the Animals above described, together with the streaks.

The Spittle of an old Man that had lived soberly, had no Animals in it; But the substance upon and between his Teeth, had a great many living Creatures, swimming nimbler then I had hitherto seen. The biggest sort were numerous, and as they moved, bent themselves like *G.* The other sorts of Animals were in great numbers, insomuch that tho the meal were little, yet the water it was mixt with seem'd to be all alive, there were also the long threads above mentioned.

The Spittle of another old man and a good fellow was like the former, but the Animals in the scurf upon the teeth, were not all killed by the parties continual drinking Brandy, Wine, and Tobacco, for I found a few living Animals of the 3^d. sort, and in the scurf between the Teeth I found many more small Animals of the 2^d smallest sorts.

I took in my mouth some very strong wine-Vinegar, and closing my Teeth, I gargled and rinsed them very well with the Vinegar, afterwards I washt them very well with fair water, but there were an innumerable quantity of Animals yet remaining in the scurf upon the Teeth, yet most in that between the teeth, and very few Animals of the first sort *A*.

I took a very little wine-Vinegar and mixt it with the water in which the scurf was dissolved, whereupon the Animals dyed presently. From hence I conclude, that the Vinegar with which I washt my Teeth, kill'd only those Animals which were on the outside of the scurf, but did not pass thro the whole substance of it.

In many of my foregoing Observations, I saw some clear shining Particles, whereof some were round, others somewhat irregular, of several bignesses, and the largest about 25 times the bulk of a blood-Globule, these if they had not sunk in water, I should have taken for Particles of fat.

The number of these Animals in the scurf of a mans Teeth, are so many that I believe they exceed the number of Men in a kingdom. For upon the examination of a small parcel of it, no thicker than a Horse-hair, I found too many living Animals therein, that I guess there might have been 1000 in a quantity of matter no bigger then the $\frac{1}{100}$ part of a sand.

A certain man being said to have worms taken out of his face, I took a quantity of these imagined worms, which I laid upon a clean Glass, that I might view them
at

at my leisure. I found them not to differ from what I gave an Account of in my Letter of the 4th of Novemb. 1681. unless it were that some of the hairs in these supposed worms were so tender, that they broke in two upon the least touch, Other worms seem'd to be a bundle of hairs, but when I went to separate them, it was just as if I had toucht a soft fat body.

I squeezed some black specks out of the thick of my own Nose, which I saw to be bundles of hairs, I then took out hairs from one of them to the number of 36.

Fig. A. B. C. D. E. is a bundle of hairs, as it appears in a Microscope, the part *A. B. C.* before I took it out of my Nose, lay even with the skin, and appear'd like a black speck; the hairs were not all of a length, but one stood out more than another, as at *B.* a single hair standing out as *B.* was transparent, and in the lower part of the bundle *C. D. E.* *A.* all the hairs together were transparent. In some bundles of hairs the part next the skin lay quite even, as if it had been cut with a pair of sizers. *E. D.* were the roots of hairs, lying one of them deeper than another.

I took the worms out of the Noses of 2 other persons, and I found the number of hairs in a bundle, to be from 3, 4, 5, 6, and 9. to 25, and 30. when the worms lay deepest in the Nose, they seldom contained any hairs, unless the person they came from were very black, and then the hairs were more easily perceivable.

In the pressing out of worms, I could tell whether there were hairs in them or no, for if the substance came out streight, then there were always hairs, but if bended and bow'd, none.

The make and conformation of these worms, I suppose to be after this manner. When the Root of a hair lying deep in the skin, supplies so much nourishment as to make the hair grow out and appear upon the face, the upper part of the hair by rubbing, or some other violence, comes

comes often to be broke off, the Trunk of it still remaining in the skin. When new matter is supplied, another hair grows by the side of the former, that was broken; and this so often till there comes sometimes to be 8. 10. 20. or 36. in a bundle. Yet this number is not made up in 1. or 2. years, but probably in a great many.

The reason of this my conclusion, is grounded upon the bluntness of the tops of all the hairs found in these worms, whereas all the other hairs growing upon the face are sharp-pointed, till such time as they come to be broken.

In the year 1674. I writ to Mr. *Oldenburg* that I found the *Cuticula*, or uppermost skin of a body to consist of round Particles or Scales: I also gave him my Opinion, how this skin was made, and how the upper part of it was worn off, and the under part came to succeed in its place.

Since that time there was little difference in what I observed, until now of late, that I have made use of another way. For at first I saw by a common Microscope the parts of the Scales appearing to the Eye as they were round, lying close in order, and so small that a sand would cover 200. or 250. of them, as is here shewn in *Fig. H.* But examining them since, by a Glass which magnified more, I am satisfied that they are not made out of the grosser part of the moisture or substance which is evaporated out of the body, as I formerly thought, but are meer Scales, such as grow upon the outward skin of a fish, and are called fish-scales.

These Scales lye upon our body, just as they do upon fishes, the most part of them are *quinque-lateral*, the figure of a whole one is here shewn by a magnifying Glass at *K*, the side *O. P.* was fast'ned to the skin, and is not so broad as if it be measured higher. Some of the Scales were not so long as *K*. and some had not the sides so even, but these last I took to be pulled off the body before they were fully grown. They are very thin, for I judge their bredth is above 25 times more than their thickness.

ness. They lie three deep upon the body, every part being covered with 3 scales successively, tho not above $\frac{1}{3}$ part of a scale discover it self to the Eye, the other $\frac{2}{3}$ parts being hid by the other scales. As *Fig. M.* where the part exposed to view is marked 1, 2, 3, 4. the rest is covered by other scales. The point 3 is not always so sharp as I have here made it, but it being like the Original, which seem'd a perfect scale, I would not alter it.

The scales of Fishes also appear but in part to the Eye, but it is very observable tho fishes never change their scales; yet men do often. Particularly I instance in my self at this time, being the *first* of *September*. That the scales came off me not by one and one, but 1000 in a Cluster. When I pluck off a scale from my body which sticks fast, and perhaps is but newly grown, there comes blood after it, or at least there remains a red spot,

I took off the skin from a scar in my Arm, caused by blood-letting 25 years since, and found the scales to have the shape of *L.*

Thro many of the aforesaid scales, there run transparent lines, in an odd manner, as at *M.* and these lines are sometimes stuck with round Balls, of the bigness of $\frac{1}{4}$ a blood-globule, as may be seen in the same Figure.

These lines, I believe are caused by the sweat of the body, bringing with it some gross substances which adhere to the scales; the Globules also may either come whole out of the body, or else be made afterwards out of the matter which is evaporated.

It's easy to conceive how a Louse, Flea, or other insect may thrust his sting or snout into the skin, for they need not do it thro the scales, but between the Plates or Mailles.

From hence also may be gathered, that there are no pores in the *Cuticula*, for the conveying out of sweat, because that may owze out from between the scales, tho they stick never so close together, without supposing

supposing that there are channels made for its passage. Let us only reckon how many Vacuities a Scale has, whereby it is nourisht so as to grow, and that in the space of $\frac{1}{3}$ part of a scale there may be 100 such Vacuities, thro which the humours of the body may pass, and that 200 such parts of a scale may be covered with a sand. It will follow then, that the body may exhale out of 20000 places in a quantity no bigger then what a sand will cover.

Hereout might be concluded that our Body is nothing but a Pore, notwithstanding what our Physicians speak of the Pores or passages for sweat, as if there were such places contriv'd by Nature for nothing else. For a drop of sweat though by the pressure of the Air it becomes round, yet it may be compounded of Particles coming from many thousand places.

I took some scales coming from the inward and most callous part of the hand, and found them of the same circumference with them of my Body, but as the one sort were very clear and transparent, so the other were so full of lines and so thick beset with Globules, that they seemed to be composed of nothing else; now we find by experience that the hand not only between the fingers, but in the hollow of it, is subject to be moist, more than other parts of the body; so that tho the scales fall off from the other parts of the body for want of nourishment, yet the scales upon the hands and feet are still kept on by a clammy moisture and fat, which being brought to that place to be evacuated, sticks to the Scales, and keeps them together, leaving only some small out-lets for the thinnest of the matter. By this means the skin of the hand, tho it be nothing but scales, comes to be of an extraordinary thickness, which may be increast by hard labour, whereby the moisture is brought into those parts, and the scales are more packed and clotted together.

A Let-

A Letter from Mr. John Collins to the Reverend and Learned Dr. John Wallis Savilian Professor of Geometry in the University of Ox'ord, giving his thoughts about some Defects in Algebra.

TO describe the *Locus* of a cubick Æquation.

A Cardanick Æquation convenient for the purpose, (*viz.* such as shall have the dioristick limits rational) must have the Coefficient of the roots to be the triple of a square number such is $a^3 - 48a = N$.

Assume a rank of roots in Arithmetical progression, and raise resolvends thereto $a^3 - 48a = N$ or resolvends.

R	N
Such are	
1	1 ---- 48 = 47
2	8 - --- 96 = 88
3	27 --- 144 = 117
4	64 -- 192 = 128
5	125 -- 240 = 115
6	216 - 288 = 72
7	343 - 336 = 7
8	512 - 384 = 128
9	729 - 432 = 297

Draw a *Base* line and a perpendicular thereto, and from O in the *Base* line prick the negative *resolvends* downwards, and the affirmative ones upwards, and raise their roots upon them as ordinates, a *Curve* passing through the same is one Moity of the *Curve* or *Locus* on the right hand for affirmative roots, and the other moity on the left hand is described in the same manner by assuming a rank of negative roots, and raising resolvends thereunto. The *Curve* Fig. 4. may give a resemblance of the thing.

And 16 the third part of the Coefficient of the roots cubed is equal to the square of 64 half the *resolvend*, or dioristick limit.

Which in composing of *Cardans* canon is always subtracted from the square of half the *absolute*, as in the example following.

If I were to find the root belonging to the *resolvend* 297

The square of half thereof is $22052\frac{1}{4}$

The square of 64 half the dioristick Limit 4196

The difference is $17956\frac{1}{4}$

And the rule is $148\frac{1}{2} \pm \sqrt{17956\frac{1}{4}}$.

$148\frac{1}{2} \pm \sqrt{17956\frac{1}{4}}$

That is in a quadratrick Æquation, if 297 were the sum of the two roots and 64 the root of the *Rectangle*: then if from the square of half the sum, the rectangle be subducted, there remains the square of half the difference of the

roots, and giving them an universal Cube root, it is

$$\sqrt[3]{148\frac{1}{2}} + \sqrt[3]{17956\frac{1}{2}} + \sqrt[3]{148\frac{1}{2}} - \sqrt[3]{17856\frac{1}{2}} \text{ to } 9 \text{ the root sought.}$$

In the former Scheme *Q. B.* and *Q. P.* may signifie the roots of *Cardans Binomials* that run infinitely upward and terminate at *Q.* as is mentioned in *Section the 5th.* And if they can be continued downwards, probably they will terminate at *O.* and *R.* The *touch* line in *Section 2d.* may here be represented by the line *g S.* and the *Chord* line between *g* and *8* by *T.* from whence tis plain that any root between *g* and *8* found near, may be limited by Approximations of *Majus* and *Minus.*

As to *CARDANS RULES*

- 1 The description of the *Locus* is before handled.
- 2 The *touch* line affording approaches by an *Æquation* derived out of that proposed is before described, and the method of drawing is mentioned by *Dr. Wallis* in the *Transactions.*
3. The Limits are of two kinds (*viz.*) either the *Base* limits when the resolvend is *O.* and the *æquation* falls a degree lower: or the *dioristick* limits whereby a pair of roots gain or loose their possibility, as is before described.
- 4 *Cardans* canons are but the sum of the roots of a solid quadratick *æquation* arising out of half the *dioristick* limit as the *v* of the rectangle, and the resolvend as the summ
- 5 If the roots of those *binomials* are separately prickt down as ordinates on their *resolvends*, they beget *curves* infinitely continued upward, and meeting in a point bisecting the root that is equal to a pair of equal roots, when the *æquation* is just limited, or *dioristick* as aforesaid in the Figure at *Q.*
- 6 If these *binomials* are prickt down as ordinates to their *resolvends*, *Mr. Newton* upon sudden thoughts, supposed they may describe both sides of an *Hyperbole.*
- 7 If so they cannot be continued downwards, but by the method in *Mercators Logarithmotechnia*: most numbers of a constant habitude belonging to any arithmetical progression, may by aid of the differences, and a Table of Figurative numbers (yea, and I add otherwise) be continued upward or downward, and if these run downward they will probably end both in the *base* limits at *O* and *R.*
- 8 If these *binomial curves* be continued downward, and separately found should always added make the root of a cubick *Æquation* capable of 3 roots: then *Cardans* impossible or negative roots are prov'd possible, and we only in ignorance how to extract them.
- 9 Assume any root within the limits of 3 possible roots, and raise a resolvend to it, and when you have done, by *Cardans* Rules improved, you may find that root, and, with a little varying

rying the same, both the other roots (as in the Postscript): for every number or magnitude capable of a *cube* root, is capable of two more, see *Section the 11th.* following.

10 If the roots in the former Section, be assumed in Arithmetical progression, and the æquation with its several Resolvends be depressed, there will come out a regular Series of Quadratick Æquations, whence an easie method will rise of writing down such ranks as multiplied by an Arithmetical progression, shall always beget the same cubick æquation, the Resolvend only varying.

11 Let the roots of this series of quadraticks be found as usual in binomials, let these binomials be cubed, and then let it be observed, whether the results are constant portions of the square of the Resolvend and of the dioristick limit: and if so, *Cardans* Rules will have their defect supplied.

12 In breaking a biquadratick, 'tis asserted that by leaving the Resolvend at liberty, it may be infinitely and rationally done, without the Aid of the separating cubick Æquation.

13 But supposing such separating cubick in store, of which *Bartholinus* in his dioristick hath given us great furniture in *Species*, why may not several roots of that æquation be assumed rational, and thence the biquadratick broken into as many pairs of quadratick æquations?

14 May not from hence a method arise of writing down 2 Series of quadraticks that multiplied together shall always beget the same biquadratick Nomes, the Resolvend only varying? and hence the *Locus* of the æquation is easily described.

15 Here again (as in the 11) if the binomial roots of these quadraticks be squaredly squared, and those results are constant portions of the cube of the Resolvend, and the dioristick limit; it will be certain there may be general furd Canons for æquations of the 4th. dimension, and *Monsieur Cluverius* (now at London) positively asserts he hath a general method to obtain them for all Dimensions

16 As *Cardans* are furd canons deriv'd from the Resolvend, and dioristick limit, so it were worthy disquisition, whether other furd Canons (of which many are fitted to particular cases by your self, *Leibnitz* and others) do not arise out of the limits of those particular cases and æquations, and whether the glimpse of a general Method might thence be deriv'd for all other æquations, though encumbered with negative quantities? which Mr. *Gregory*, a little before his death, said he had attained.

17 The Learned Dr. *Pell* hath often asserted that after the Limits of an æquation are once obtain'd, then it is ea-

fy to find all the roots to any Resolvend offer'd.

Now for instance (according to *Huddens* method) in a biquadratick æquation, you must multiply all the terms beginning with the highest, and so in order by 4, 3, 2, 1. and the last term or Resolvend by 0. whereby it is destroyed, and you come to a cubick Æquation, the same as *Harriot* uses to take away the penultimæ Term of the biquadratick, the roots whereof being found, and as roots having Resolvends raised thereto in the biquadratick Æquation, are the dioristick Limits thereof.

18 And if this easy method were known, we may come down the Ladder to the bottom, and fall into irrational quantities, and ascend again. Against which assymetry, an Æquation might be assumed low, as a rational quadratick, and thence a cubick Æquation formed, whose limits should be found by aid of the quadratick Æquation, and out of that cubick a Biquadratick Æquation, whose limits should be found by the aid of that cubick Æquation, &c.

19 Æquations may be so continued of two Nomes, that both the dioristick and base limits, should be rational, then supposing such Æquation incomplete, the increasing or diminishing the roots, fills up all the vacant places.

Q. Whether or in what place one or both sorts of Limits shall loose their rationality? And what is the nature of the roots thus drawn? in this I think you have already determined in divers of your sord Canons.

20 What Dr. *Pells* method mention'd in *Section* 17 should be I cannot guess, unless it be either

To make sord Canons. Or good approaches.

Or that raising Resolvends out of assumed roots, those should make a store from whence to derive the roots of the Resolvend offered.

Or making quadratick Æquations out of the dioristick and base limits, those might be interpolated, by aid of a Table of figurate numbers, or otherwise thereby, as in quadratick Æquations to attain two roots of a biquadratick at once. which if performed the greatest difficulties are overcome, and why should not this seem probable, in regard the *Curve* or *Locus*, be the Æquation what it will, makes indented porches.

21 Suppose I should propound two cubick or biquadratick Æquations, in both whereof all the signs are +. It is propounded out of these two, to derive a third Æquation, whose root shall be the Summ, Difference, or Rectangle of the Roots of the two Æquations propounded. This Mr. *Gregory* a little before his death writ word he had obtained and in the following Series for finding the Moity of a Hyperbolick Logarithm I suppose made use of.

From

From a number propos'd subtract an Unit, let that be Numerator, and to it add an Unit, let that be Denominator, and call that fraction N .

Then $N + \frac{3}{N} + \frac{5}{N} + \frac{7}{N} + \frac{9}{N} + \frac{11}{N} + \frac{13}{N}$, &c. is

Equal to half the Hyperbolick Logarithm sought.

EXAMPLE in the Number 2.

N

The Fraction is $\frac{1}{3}$

1, 3333333 = 3333333

3, 370370 = 123456

5, 41152 = 8230

The Rank N is easily 7,

4572 = 653

made by dividing ev'ry 9,

508 = 56

preceding number by 9.11,

56 = 5

13,

6 = 0

3465733

6931466 which is

The Hyperbolick Logarithm of 2 sought.

I want time to consider the promises, but hope you will, (in regard you seem to think it strange that any difficulties should remain about Cubicks that are not presently resolved) your considerations wherein will be very acceptable and worthy publick view.

Other Series in Print of *Mercators*, &c. dispatch not as this doth neither thereby can the Logarithm of 2 be easily made, but by making the Logarithms of such mixt numbers or fractions that multiplied together make the result 2 just as $2 \times 1\frac{1}{2} = 3$; whence having and finding that of $1\frac{1}{2}$, you presently have the Logarithm of 3.

22 A *Cardanick* Equation that is a Cubick one wanting the second term, may be multiplied or divided by a rank of continual proportionals, so as to render the coefficient of the roots canonick, that is, to make it the same with the Equations of the Table, that find the Sine, Tangent, or Secant of the third part of that arch to which any Sine, Tangent, or Secant is propounded, and so finding the roots in the tables, those sought are thence obtained by Multiplication or Division. Yea, and the coefficient of the roots may in like manner be rendred an Unit and then the Resolvends sought in a table of the sums or differences of the Cubes of numbers and their roots, shall help you to such roots, as multiplied or divided as aforesaid shall be the true ones sought.

23 It is an enquiry worth consideration, whether two of the roots of a biquadratick may not be kept constant, and the

the rest be encreased or diminished, either Arithmetically, or by multiplication and division in a known *Ratio*: certainly regular Progressions will arise, though as yet, we cannot encrease the true roots of an *Æquation* without as much diminishing the Negative, nor can we multiply or divide the roots without we alter all of them, and consequently cannot reduce coefficients to such habitudes as are desirable.

24 It is a pleasant concinnity out of a root to raise a Resolvend without raising any of the Powers of the root, and at the same time without a thorough binomial Division to deprefs the Æquation a degree lower.

EXAMPLE.

Let the Equation be $a^4 + 10a^3 + 6a^2 + 20a = 1072$.

Let the root be 4, the resolvend is thus raised by adding the coefficients as you go, and multiplying by the root, thus $4^4 + 10 = 14 \times 4 = 56 + 6 = 62 \times 4 = 248 + 20 = 268 \times 4 = 1072$. with the same work the Equation may be depressed without Division.

EXAMPLE.

EXAMPLE.

Let the $\mathcal{A}$ equation be as before, and place the root with the former products underneath respectively, the sum is the depressed $\mathcal{A}$ equation.

$$a_4 + 10a_3 + 6a_2 + 20a_1 + 1072 = 0$$

The sum $a^4 + 14a^3 + 62a^2 + 68a = 0$. that is divided by a .

$$a^{14}a^{\dagger}6_2a^{\dagger}268=0.$$
 which is the under $\mathcal{A}$ -

quation fought found without Division

25 It's conceived that all $\mathcal{A}$ equations may be so regulated as to be reduced to as many Arithmetical Progreſſions of multipliers in whole numbers, as the $\mathcal{A}$ equation hath dimensions, whereof one of the progreſſions ſhall be a Series of roots: hence the raiſing Reſolvends by tentative work is rendred Logarithmetical. For Example write down any 3 arithmetical Progreſſions, viz.

R H

$1 \times 6 \times 3 = 18$
 $2 \times 7 \times 5 = 70$
 $3 \times 8 \times 7 = 168$
 $4 \times 9 \times 9 = 324$
 $5 \times 11 \times 13 = 715$

I say the Rank H. are the Resolvends or
Homogenea Comparationis of a cubick Equation
 whose roots are the Rank R. This cubick Equation
 is easily attained out of the differences of the Rank R.
 for out of the Rank R in any Equation proposed
 raise separately the respective powers (with regard to
 their Coefficients) and out of the three ranks so raised
 compose their respective differences, and they shall be the
 same with the differences of the rank of Resolvends or
Homogenea Comparationis here noted by H.

If

If such *Æquation* be encombred with fractions they are all removed at once, by multiplying most conveniently, by the least number that is divisible by the Denominators of such fractions, hence also the infinite Series before mentioned (and others) are reduceable to Logarithms.

26 Where *Æquations* have all their terms adected with the same sign both (+ or —) *Mr. Newton* and *Mr. Gregory* deceased have affirmed they are all reduceable to some pure high power, which is of singular use in the infinite Series. And a Learned *German* where this cannot be done, hath asserted that they may be reduced to a higher power, with a variable Coefficient, which is the root sought with a common addend or subducend. And even this would render an easy tentative Logarithmetical way for attaining the root.

27 If but one Root of an *Æquation* can be found at a time, then questionless a better Method is not yet attained, then what is mentioned in the printed proposal about Printing *Mr. Bakers* Treatises therein mentioned.

28 Lastly, as to Constructions for *Æquations*, the following Probleme seems to be universal.

Any two analytick *Curves* (*viz.*) such as wherein the Habitude between the Base and Ordinate may be expressed by an *Æquation*, being given in Magnitude and Position, and from the points of their interfection ordinates let fall to the *Axis* of either figure, or upon parallels to the said *Axis*, the inquiry is of what *Æquation* those ordinates are the roots? *Dr. Barrow* liked the proposition as well grounded, and left a discourse about doing it in the conick Sections, in which there are 3 cases, either the axes are parallel, or being produced concur, beyond the vertexes of the figures without; or otherwise intersect within the figures, *Mr. Gregory* entred on the same contemplation, but death deprived us of the benefit of his thoughts.

Of Analytick (*alias* Geometrick) *Curves* there are innumerable sorts, of which I shall mention one or two kinds.

Between an Arithmetical Progression and its squares, or between its squares and its cubes, or its cubes and Biquadratics, there may be interpolated as many Arithmetical or Geometrical means as you please: and thence *Loci* or *Curves* deriv'd, which some call *Paraboloids* or *Parabolasters*, see *Gregories Geometriae pars universalis* printed in Italy in Quarto.

Postscript explaining Section the 9th.

After you have obtained the Cube roots of *Cardans* Binomials, according to *Van Schooten*, in *Des Cartes* or *Kesler*, if you change the Sines of the rational parts of those roots, as also the

the Sines of the Radical Parts, and multiply those parts by 3, the results are also roots of the cubick Æquation first proposed.

EXAMPLE.

$$aaa - 21a - 20 = 0$$

The cube Roots of the Binomials are $+2\frac{1}{2} + V-\frac{3}{4}$
 $+2\frac{1}{2} - V-\frac{3}{4}$

Their sum is the Root sought $= +5$

And the other two Roots are $2\frac{1}{2} + V2\frac{1}{4}$
 $2\frac{1}{2} - V2\frac{1}{4}$

$$\text{Also in this Æquation } a^3 - 60a - 32 = 0$$

The Binomial Roots are $+4 + V-4$
 $+4 - V-4$

Hence the Root sought is $+8$

And the other two roots are $-4 + V+12$
 $-4 - V+12$

ADVERTISEMENT.

These papers were sent by Mr. Collins to Dr. Wallis in a Letter of 3 Octob. 1682, (with this Character, *I have sent you herewith my thoughts about some defects in Algebra:*) and are a Copy of what he had written to some other (but I know not whom) to whom he speaks all along in the second person, whereas of others he speaks in the third person. And he did intend (had he lived longer) to perfect it further; by omitting some things which (though here he notes as defects) he found after to be done already, and supplying some others. But he lived not to perfect it, and therefore (that it be not lost) we here give it as we found it.

O X F O R D,

Printed at the THEATER, and are to be sold by Moses Pitt,
 at the Angel, and Samuel Smith, at the Princes Arms in St.
 Paul's Church-yard LONDON. 1684.

The Longitudes, Latitudes, right Ascensions, and Declinations of the chiefeſt fixt Stars according to the beſt Obſervers; in a Letter from Mr. Edward Bernard, to the reverend and learned Dr. Rob. Huntington Provoſt of Trinity College near Dublin in Ireland.

Edvardus Bernardus Roberto Huntingtonio S.

DUM dies aliquot rigidiffimæ omnium brumæ, quarum apud vivos memoria, in Muſeo Mertonenſi, ubi te nuper ac olim novimus, ego forte comburerem, crudamque tui abſentiam oportunitate loci quadantenus lenirem: inter codices tuos Arabicos (numeras autem plus quadraginta doctrinæ & obſervationis Sideralis refertis) in Tabulis Ilchanicis ſtudio Perſæ præclari Choagæ Naſirodini Tuſii factum offendi, ut precipui honoris ſtellas fixas ſecundum variorum Aſtronomorum varia obſervata, qua Latæ ut Loquuntur, quæve illæ Longæ in cælo deprehendebantur, brevis pagina repræſentaret. Hoc ergo Canonion partim ex tuo peculio, ut vides, partim ab aliis adauxi. Non equidem quaſi rem magnam mihi viderer adeo feciſſe. Verum ut noſtri homines ſenſum ac opinionem aliquam concipiant Aſtronomiæ Orientis, ubi arſea primum nata conſtat: aut ſubtiliora adhuc deſiderent pro otio noſtro exArabum Almageſtis exponenda: aut potiſſimum, ut tu, Vir chariſſime, amicitia noſtræ teſſeram habeas non obſcuram, ſed notam tibi ac familiarem. Multa ſane commendant Aſtronomiam Orientalium Felicitas quidem & claritas regionum, ubi obſervatum: Machinarum granditas & accuratio, quantas plerique noſtri credere nolunt cælo ipſos obvertiſſe. Contemplantium inſuper numerus & ſcribentium, decuplo major quam apud Græcos Latinosque celebratur. Adde decuplo plures, munificentiores, ac potentiores Principes, qui viris boni ingenii ſuntus & arma cæleſtia dederunt. Quid vero Aſtronomi Arabum in Cl. Ptolemæo, magno Conſtructore artis Cæleſtis, injuria nulla reprehenderint: quam illi ſollicite temporis minutias, per aquarum guttulas, immanibus Sciotheris, imo (mirabere) fili penduli vibrationibus, jampridem diſtinxerint & menſurarint: quam etiam perite & accurate verſaverint in magno molimine ingenii humani, de ambitu intervalloque binorum Luminarium & noſtri Orbis, una epiſtola narrare non debet. Bene tibi, antiquiſſime amicorum, bene philoſophis Hibernis.

Dabam ex Bibliotheca veſtra Orientali apud Oxoniam VI. KAL. Apriles. CIOCLXXXIII.

CANON PRÆCIPUARUM ESTELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

m. Meridionalis.
b. Borealis.

*a Cl. Ptolemæo in magna
Syntaxi an. Christi. 137.*

1. 34. **U**ltima Fluvii. ὁ ἐξ αὐτοῦ ποταμοῦ λαμπρός. } Long. Latit. Magnit.
آخر النهر. الظليم. ايلاذ. } V 10 30'. 53 30' m. 1.
al. 50'. }
2. 12. Lucida cathedræ Cassiopeæ. ὁ ἐπὶ μέσῃ τῇ ἀνα- }
κλίθρῃ. كلف الخضيف. χέρ βεβαιμμένη. } V 7 50'. 51 40' b. 3.
al. 50'. }
3. 12. Persei caput Medusæum. ἡ ἐν τῇ γοργονείῃ ὁ }
λαμπρός. γοργόνιον. Algol. رأس الغول. κεφαλή } V 29 40'. 23 0' b. 2.
ἵππου. rectius μορμύς. } al. 20'. }
4. 14. Oculus Tauri austrinus. ὁ λαμπρός τῇ ὑάδων ἐπὶ τῇ }
νοτίᾳ ὀφθαλμῷ ὑπόκρινος. λαμπύρας. ὄμμα βοός. } δ 12 40'. 5 10' m. 1.
عين الثور. العين البران. } al. 20'. }
5. 35. Orionis pes sinister. ὁ ἐν τῇ αἰετῇ ἀκρόποδι τῇ }
ἀρίων λαμπρός, ἡ ὑάδων κοινός. Rigel. πῦρ δι- } δ 20 50'. 31 30' m. 1.
δύμων. رجل الجوزا اليسرى. } }
6. 3. Capella Aurigæ. ὁ ἐπ' αἰετῇ ὅμοι τῇ ἡνίοχῃ, κα- }
λέμενος αἰζ. αἰζκ, عيوق, Pleiadum remora. } δ 25 0'. 22 30' b. 1.
al. 50'. }
7. 2. Orionis humerus dexter. ὁ ἐπὶ δεξιῇ ὅμοι τῇ ὀ- }
ρίωνος λαμπρός ὑπόκρινος. ὅμοι διδύμων. جد الجوزا. } II 2 0'. 17 0' m. 1.
Aliquibus humerus sinister præcedens. } }
8. 1. Sirius in ore Canis majoris. ὁ ἐν τῇ σύματι τῇ }
κύωνος λαμπρότατος, καλέμενος κύων, ὑπόκρινος. } II 17 40'. 39 10 m. 1.
σάηρ ἰαμανή, شعري جماديه, Sirius australior. } al. 20'.
Alhabor, العبور, γαλαντοπό. }
9. 2. Procyon, aut Canis minor. ὁ κατὰ τὴν ὀπίσθιον τῇ }
ποροκυῶνος λαμπρός, καλέμενος ποροκύων. σάηρ σιμμή, }
شعري شاميه, Sirius borealior. Algomei- } II 29 30'. 16 10' m. 1.
fa, الغميصا, tamquam lippa. } al. 10'. }
10. 8. Cor Leonis. ὁ ἐπὶ τῇ καρδίᾳ τῇ λέοντος, καλέμενος }
βασιλίσκος. Regulus, قلب الأسد. الملكي. } δ 2 30'. 0 10' b. 1.
al. 10'. }
11. 14. Spica Virginis. ὁ ἐπὶ τῇ αἰετῇ ἀκροχείρῃ τῇ }
παρθένης, καλέμενος εἰχίς. μικρὸς κονταράτος, } ηρ 26 40'. 2 0' 6.
سماك الاعرج, fulcrum inermis. السنبال. }

CANON PRÆCIPUARUM E STELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

*a Cl. Ptolemæo in magna
Syntaxi an. Christi 137.*

Long. Latit. Magnit.

2. 23. Arcturus. ὁ μεταξύ τῆ μυρῶν τῆ βοώτου, καλέμβρος
ἀρκιῦρος, ὑπόκυρρος. κονταράτος. *سماك الرامح*, $\rightarrow 27^{\circ} 0'. 31^{\circ} 30' b. 1.$
τὸ ἔρεσμα τῆ ὀπίτης.
3. 8. Antares. ἡ ἐν τῇ σώματι τῆ σκορπίου ὁ μέσος καὶ
ὑπόκυρρος, καλέμβρος ἀντάρης. καρδία σκορπίου, $\rightarrow 12^{\circ} 40'. 4^{\circ} 0' m. 2.$
قلب العقرب. $al. 20'.$
4. 1. Caput Ophiuchi. ὁ ὅπῃ τῆ κεφαλῆς τῆ ὀφιοχου.
رأس الكواكب, ὁποιμῶν. $\rightarrow 7^{\circ} 24' 50'. 36^{\circ} 0' b. 3.$
5. 1. Lucida Lyræ. ὁ λαμπρὸς ὅπῃ τῆ ὀστράκας, καλέμβρος
λύρας. γυφ. καθεμῶν, *النسر الواقع*. $\rightarrow 17^{\circ} 20'. 62^{\circ} 0' b. 1.$
6. 3. Aquilæ lucida. ὁ ὅπῃ τῆ μεταφρένας τῆ αἰετὸς λαμ-
πρὸς, καλέμβρος αἰετός. γυφ. πετόμβρος, *النسر الطائر*. $\rightarrow 3^{\circ} 50'. 29^{\circ} 10' b. 2.$
7. 5. Lucida in cauda Cygni. ὁ ἐν τῇ ἑρᾷ τῆ ὀρνιθός
λαμπρὸς. ἑρᾷ ὀρνιθός, *ذنب الدجاجة*, $\rightarrow 9^{\circ} 10'. 60^{\circ} 0' b. 2.$
ذάδουχος.
8. 3. Lucida in crure dextro Pegasi. ὁ ὅπῃ τῆ δεξιᾷ
ἴμου τῆ ἵππου καὶ τῆς τῆ ποδὸς ἐκφύσεως. Seat. $\rightarrow 2^{\circ} 10'. 35^{\circ} 0' b. 2.$
الفرع المقدم. منكب الغرس.
9. 2. Alæ Pegasi ultima. ὁ ὅπῃ τῆς ὀσφύος τῆ ἵππου
καὶ ἀκροῦ τῆ πτέρυγος αὐτῆς. πύργας. Algenib. $\rightarrow 12^{\circ} 10'. 12^{\circ} 30' b. 2.$
الفرع الموتر, جناح الغرس.
20. 7. Persei lucidum latus. ὁ ἐν τῇ δεξιᾷ πλάτῃ τῆ
πρωτέως λαμπρὸς. πλάτῃ πρωτέως. *مرفق الثريا*. $\rightarrow 8^{\circ} 450'. 30^{\circ} 0' b. 2.$
Pleiadum cubitus. *الكف البعنا*,
manus curta.
21. 27. Cauda Leonis. ὁ ἐπ' ἀκρας τῆς ἑρᾷς τῆ λέοντος. $\rightarrow 24^{\circ} 30'. 11^{\circ} 50' b. 1.$
الصفرة.
22. 1. Os Piscis australis in aqua extrema. ὁ ἐν τῇ
σώματι τῆ ἰχθύος τῆ νοτίου. σῶμα ἰχθύος μέσον. $\rightarrow 7^{\circ} 0' 23^{\circ} 0' m. 1.$
فم السمك الجنوبي.
23. 44. Canopus. ἡ ἐν τῇ νοτίῳ πιδυλίῳ τῆς ἀργῆς ὁ προη-
γέμβρος, καλέμβρος κηφωτός. σάλη ἰσμανή, $\rightarrow 17^{\circ} 10'. 75^{\circ} 0' m. 1.$
اليمن, quasi fidus benignum.

[570]
PRÆCIPUARUM FIXARUM CANON JUXTA
OBSERVATIONES SELECTAS.

γ. Abdorahmani
Sophio an. Christi
964. Is cum Prole-
mao convenit α. π.
αλ' ατος.

	Longit.	Latit.	Longit.
1 Ultima fluvii.	0. 11, 50'. 53 30'		0 12 53'
2 Lucida cathedræ Cassiepeiaë.	0. 20, 20'. 51 45'		0 20 32'
3 Persei caput Medusæum.	1. 12, 17'. 22 45'		1 12 22'
4 Oculus Tauri austrinus.	1. 24, 35'. 5 15'		1 25 22'
5 Orionis pes sinister.	2. 2, 1. 31 4'		2 2 32'
6 Capella Aurigæ.	2. 6, 49'. 22 50'		2 7 42'
7 Orionis humerus dexter. <i>Non nullis</i> <i>humerus sinister præcedens.</i>	2. 13, 16'. 16 45'		2 14 42'
8 Sirius.	2. 29, 30'. 39 20'		3 0 22'
9 Procyon.	3. 10, 40'. 16 0'		3 11 12'
10 Cor Leonis.	4. 14, 40'. 0 15'		4 15 12'
11 Spica Virginis.	6. 8, 23'. 2 6'		6 9 22'
12 Arcturus.	6. 8, 50'. 31 12'		6 9 42'
13 Antares.	7. 24, 35'. 4 24'		7 25 22'
14 Caput Ophiuchi.	8. 6, 53'. 36 0'		8 7 32'
15 Lucida Lyræ. Vultur cadens.	9. 0, 40'. 61 45'		9 0 2'
16 Aquilæ lucida. Vultur Volans.	9. 15, 53'. 29 12'		9 16 32'
17 Lucida in cauda Cygni.	10. 20, 4'. 59 36'		10 21 52'
18 Lucida in crure dextro Pegasi.	11. 14, 0'. 31 10'		11 14 52'
19 Alæ Pegasi ultima.			11 24 52'
20 Persei lucidum latus.	1. 16, 15'. 30 8'		1 17 32'
21 Cauda Leonis.	5. 6, 40'. 11 50'		5 7 12'
22 Os Piscis australis.			10 18 12'
23 Canopus.			2 29 52'

δ Ebn.

CANON PRÆCIPUARUM ESTELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

8. Ebnolalame an. e. Ex Canonibus 5. Choaga Nasiro- 7. Ex Sultanicis n. Abdolga-
Christi 980. Hacimicis Johanno Tufio in Ta- Ologbeci anno lilo Segazzo
nida Egyptij an. bulis Ilchanicis an. Christi. 1437. in Geneth-
Christi 996. Chr. 1233. liacis anno
Chr. 1261.

Longit.	Latit.	Longit.	Latit.	Longit.	Latit.	Longit.	Latit.	Longit.
01.6,42'.53,30'	0.16,20'.53,28'	0.24,55'.51,45'	0.15,40'.53,45'	0.6,45'				
0.24,9'.51,45'	0.24,34'.51,50'	0.24,35'.51,40'	0.28,1'.50,48'	0.25,2'				
1.15,1'.22,45'	1.15,24'.22,39'	1.16,25'.23,30'	1.18,54'.22,0'	1.16,52'				
1.28,40'.5,15'	1.29,7'.5,15'	1.29,22'.5,13'	2.2,31'.5,15'	1.29,45'				
2.5,55'.31,20'	2.5,30'.31,35'	2.6,35'.31,30'	2.9,25'.31,18'	2.6,52'				
2.10,50'.22,50'	2.11,32'.22,3'	2.11,10'.22,40'	2.14,43'.22,42'	2.11,43'				
2.17,21'.16,45'	2.17,46'.16,50'	2.18,0'.16,50'	2.21,13'.16,43'	2.19,12'				
3.3,40'.39,20'	3.4,2'.39,30'	3.3,50'.39,10'	3.6,19'.39,30'	3.4,28'				
3.15,45'.16,0'	3.15,52'.16,2'	3.15,45'.16,5'	3.18,22'.16,0'	3.16,11'				
4.18,45'.0,15'	4.19,10'.0,10'	4.19,14'.0,17'	4.22,13'.0,9'	4.19,42'				
6.12,33'.2,6'	6.12,58'.2,10'	6.13,25'.1,52'	6.16,10'.2,9'	6.13,26'				
6.12,55'.31,12'	6.13,49'.31,33'	6.13,0'.31,25'	6.16,31'.31,18'	6.13,47'				
7.28,40'.4,24'	7.29,9'.4,25'	7.29,0'.4,10'	8.2,16'.4,30'	7.29,45'				
8.11,2'.36,0'	8.11,34'.35,59'	8.11,15'.35,55'	8.15,13'.55,51'	8.11,49'				
9.4,45'.61,45'	9.5,0'.61,55'	9.4,40'.61,50'	9.8,19'.62,0'	9.5,38'				
9.20,58'.29,14'	9.20,34'.29,10'	9.20,40'.29,15'	9.24,10'.29,15'	9.20,56'				
10.24,9'.59,36'	10.23,31'.59,38'	10.24,30'.59,50'	10.28,46'.59,42'	10.26,15'				
11.18,54'.31,10'	11.18,44'.31,12'	11.18,44'.31,12'	11.21,37'.30,51'	11.18,58'				
11.24,52'.12,30'		11.18,55'.31,1'	0.1,22'.12,34'					
*Non vidit unquam nepos Timuri clarum Canopum; non ceteri hujus Ca- nonis, exceptus Alexandrinis.				1.21,35'.30,0'	1.25,7'.29,21'	1.22,2'		
				5.11,55'.11,50'	5.13,49'.12,0'	5.11,38'		
				10.23,45'.23,0'	10.20,40'.21,30'	10.23,53'		
		3.3,55'.75,0'	*			3.4,3'		

PRÆCIPUARUM FIXARUM CANON JUXTA OBSERVATIONES SELECTAS.

	9 Ex Perseis Chrysocece anno Chr. 1115.	Ex Canonibus Persarum Pembrochianis an Chr. 1346. Melixæ 338.
	Longit.	Longit.
1 Ultima fluvii.	V 15 10	0
2 Lucida cathedræ Cassiepeæ.	V 22 50	0
3 Persei caput Medusæum.	8 14 40	18 10
4 Oculus Tauri austrinus.	8 27 0	II - I 30
5 Orionis pes sinister.	II 4 50	8 20
6 Capella Aurigæ.	II 10 50	13 3
7 Orionis humerus dexter. Non nullis humerus sinister præcedens.	II 17 0	20 30
8 Sirius.	☉ 2 40	18 0
9 Procyon.	☉ 14 10	18 0
10 Cor Leonis.	♋ 17 30	9 31
11 Spica Virginis.	♍ 11 40	15 10
12 Arcturus.	♍ 12 0	15 30
13 Antares.	♋ 27 40	+ I 10
14 Caput Ophiuchi.	0	0
15 Lucida Lyræ. Vultur cadens.	♌ 2 20	5 0
16 Aquilæ Lucida. Vultur Volans.	♌ 18 50	22 20
17 Lucida in cauda Cygni.	☿ 24 10	10 20
18 Lucida in crure dextro Pegasi.	♋ 17 10	20 40
19 Alæ Pegasi ultima.	♋ 27 10	0
20 Persei lucidum latus.	8 19 50	0
21 Cauda Leonis.	0	np 13 0
22 Os Piscis australis.	☿ 22 0	0
23 Canopus.	II 2 10	0

PRÆCIPUARUM FIXARUM CANON JUXTA OBSERVATIONES SELECTAS.

12 Ex Codice Arnoldino a- pud Gassen- dum pro anno Christi 1364.			16 Ex Codicibus Illustrum vi- rorum Savilii & Bodleii, quasi pro an. Chr. 750.			17 Mohammedi Tizinio anno Christi 1533.		
Longit.			Longit.			Ascens. recta.		Declin.
V	18	20'	V	12	20'	130	17'	41 0
8	17	45'	8	2	50'	86	55'	56 41'
II	1	0'	8	19	50'	130	14'	39 43'
II	8	0'	II	2	10'	153	0'	15 43'
II	13	10'	II	9	10'	163	43'	9 13'
II	18	10'	II	24	50'	161	39'	45 0'
6	6	0'	6	6	40'	173	15'	6 28'
6	17	20'	6	9	39'	187	0'	15 50'
8	20	40'	8	4	50'	199	0'	6 5'
12	15	0'	8	4	10'	236	0'	14 8'
12	14	10'	mp 7	19	20'	285	36'	8 29'
+	27	40'	+	24	0'	299	0'	22 14'
mp	5	30'	12	15	0'	330	57'	22 42'
mp	22	0'	+	15	0'	348	57'	13 9'
mp	27	18'	12	0	0'	38	37'	5 29'
+	20	20'	12	0	0'	22	5'	7 24'
	0	0'	12	0	0'	36	40'	43 50'
	0	0'	12	0	0'	71	0'	25 16'
mp	12	40'	mp	1	45'	88	10'	12 23'
	0	0'				133	46'	47 52'
	0	0'				261	20'	17 55'
						68	45'	33 51'
						183	40'	51 35'

CANON PRÆCIPUARUM ESTELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

	<i>id. Saheboano Alepenſi ad Il- chanicas pro an. Chr. 1436. Aſcenſ. Declin.</i>	<i>ii. Oladino Sateridæ in Ta- bulis Damasceſis anno Chriſti. 1480. Longit. Aſcenſ. Declin.</i>
1 Ultima fluvii.	132,10'.41,30'	0.20,34'.129,30'.17,0'
2 Lucida cathedræ Caſſiopeiæ.	84,2'.55,45'	0.18,16'.83,50'.55,50'
3 Perſei caput Meduſæum.	127,44'.39,4'	1.20,4'.127,55'.38,50'
4 Oculis Tauri auſtrinus.	150,40'.15,20'	1.3,4'.149,50'.15,0'
5 Orionis pes finifter.	162,20'.9,20'	0.167,50'.5,10'
6 Capella Aurigæ.	158,30'.44,43'	2.15,24'.157,40'.44,40'
7 Orionis humerus dexter. <i>Non- nullis humerus finifter præcedens.</i>	171,55'.6,15'	2.22,24'.170,10'.6,10'
8 Sirius.	185,45'.15,43'	4.4,4'.184,20'.15,45'
9 Procyon.	197,25'.6,7'	4.19,44'.196,20'.6,30'
10 Leonis.	234,0'.15,10'	4.24,44'.233,30'.15,5'
11 Spica Virginis.	283,40'.7,30'	6.16,30'.283,20'.7,30'
12 Arcturus.	297,39'.33,8'	6.17,24'.297,0'.23,30'
13 Antares.	331,0'.24,12'	8.3,4'.322,0'.24,15'
14 Caput Ophiuchi.	347,5'.13,20'	
15 Lucida Lyræ. Vultur cadens.	38,32'.4,20'	9.7,44'.4,0'.38,30'
16 Aquilæ iucida. Vultur Volans.	20,5'.7,3'	9.24,14'.20,0'.7,5'
17 Lucida in cauda Cygni.	36,20'.43,15'	35,10'.4,30'
18 Lucida in crure dextro Pegafi.	68,50'.24,30'	11.22,34'.68,20'.24,0'
19 Alæ Pegafi ultima.	85,54'.11,30'	0.2,34'.85,5'.11,30'
20 Perſei lucidum latus.	130,20'.47,11'	127,20'.1,40'
21 Lauda Leonis.	259,30'.17,55'	5.14,54'.259,5'.18,10'
22 Os Piſcis auſtralis.	67,25'.35,2'	10.24,24'
23 Canopus.	183,30'.5,25'	181,15'.51,50'

CANON PRÆCIPUARUM ESTELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

15 Ex Tabulis Ro-
dolphinis an. Chr. 1600.
ad Contemplationes Ty-
chonis Brahei.

15. Ricciolo Boroniensi in Astronomia Reformata
anno Christi, 1660.

Longit. Latit. Longit. Latit. Ascens. Declinat.

1.	V. 21, 10. 53, 30. V. 22, 0', 14". 53, 30, 0.				
2.	V. 29, 35½. 51, 14½. 8. 0, 22', 0". 51, 17', 0". 357, 44', 33". 57, 18', 40".				
3.	8. 20, 37'. 22, 22'. 8. 21, 32', 10". 22, 22', 40". 41, 33, 54". 39, 36, 30".				
4.	II. 4. 12½. 5, 31'. II. 5, 1', 43". 5, 30, 50". 64, 6', 58". 15, 46, 10".				
5.	II. 11, 37'. 31, 11'. II. 12, 3', 10". 31, 10', 10". 74, 32', 38". 8, 37', 30".				
6.	II. 16, 16'. 22, 50½. II. 17, 6', 15". 22, 51', 45". 72, 52, 20". 45, 36', 0".				
7.	II. 15, 23'. 16. 63'. II. 16, 13', 0". 16, 52, 30". 76, 45', 4". 5, 59', 50".				
8.	☉. 8, 35½. 39, 30'. ☉. 9, 3', 0". 39, 32', 5". 97, 30', 18". 16, 16', 30".				
9.	☉. 20, 18½. 15, 57'. ☉. 21, 6', 30". 15, 57', 10. 110, 22', 32. 6, 4', 0".				
10.	♌. 24, 17'. 0, 26½. ♌. 26, 4', 45". 0, 26', 20". 147, 31', 14". 13, 36', 30".				
11.	♍. 18, 16. 1, 59'. ♍. 19, 6, 0. 1, 59', 30". 196, 51', 0". 9, 20', 30".				
12.	♍. 18, 39½. 31, 2½. ♍. 19, 30', 40". 31, 0, 40". 210, 4', 38". 20, 59', 50".				
13.	♎. 4, 13'. 4, 27'. ♎. 5, 1', 40". 4, 26, 30". 242, 10', 40". 25, 33', 30".				
14.	♎. 16, 50'. 35, 57'. ♎. 17, 43', 20". 35, 56', 15". 259, 47', 14". 12, 52', 30".				
15.	♏. 9, 43. 61, 47½. ♏. 10, 32', 40". 61, 47', 0". 276, 19', 32". 30, 30', 40".				
16.	♏. 26, 9'. 29, 21½. ♏. 26, 58', 30". 29, 20', 40". 293, 31', 59". 8, 1', 20".				
17.	♐. 29, 53½. 59, 56½. ♐. 0, 41', 25. 59, 57, 20. 307, 26', 35". 44, 6', 40".				
18.	♐. 23, 49½. 31, 7½. ♐. 24, 40', 20". 31, 8', 20". 341, 51', 48". 29, 15', 50".				
19.	♐. 3, 28½. 12, 35'. ♐. 4, 26', 20". 12, 37', 0". 358, 57', 0". 13, 19', 20".				
20.	♑. 26, 17'. 30, 5'. ♑. 27, 0', 8". 30, 5', 40". 44, 52', 30". 48, 34', 30".				
21.	♒. 16, 3'. 12, 18'. ♒. 16, 53', 0". 12, 16', 20". 172, 53', 58". 16, 27', 40".				
22.	♒. 28, 11½. 21, 0'. ♒. 29, 2', 56". 20, 59', 40". 339, 37', 0". 31, 20', 10".				
23.					

III. PRÆCIPUARUM FIXARUM DISTANTIÆ JUXTA OBSERVATIONES SELECTAS.

1 Ultima fluvii.	1. o.
2 Lucida cathedræ Cassiepeïæ.	2. à Seat 33, 4'. à cauda cygni 33, 32 $\frac{1}{2}$ '.
3 Persei caput Medusæum.	3. à latere Persei 9, 23 $\frac{1}{2}$ '. à capella 23, 37'.
4 Oculi Tauri austrinus.	4. à Sirio 45, 58 $\frac{1}{3}$ '. ab Algomeisa 46, 22'.
5 Orionis pes sinister.	5. ab oculo tauri 26, 33'. à capella 54, 15 $\frac{1}{2}$ '.
6 Capella Aurigæ.	6. ab oculo tauri 36, 43 $\frac{1}{2}$ '. à Persei latere 19, II $\frac{1}{12}$ '.
7 Orionis humerus dexter. <i>Non-</i> <i>nullis</i> humerus sinister præcedens.	7. ab oculo tauri 15, 47 $\frac{3}{5}$ '.
8 Sirius.	8. ab Algomeisa 25, 42'. à rigel 23, 40'.
9 Procyon.	9. à regulo 37, 20'. à rigel 38, 37 $\frac{1}{2}$ '.
10 Cor Leonis.	10. à Spica 54, 2'. à cauda cygni 24, 39 $\frac{1}{2}$ '.
11 Spica Virginis.	11. ab Arcturo 33, 2'. ab Antare. 45, 52'.
12 Arcturus.	12. à regulo 59, 49'. ab Antare 56, 4 $\frac{1}{2}$ '.
13 Antares.	13. à lucida Aquilæ 60, 9 $\frac{1}{2}$ '. à cauda Leonis 24, 39 $\frac{3}{5}$ '.
14 Caput Ophiuchi.	14. à Spica 36, 14 $\frac{1}{2}$ '. à lyræ lucida 29, 33 $\frac{2}{3}$ '.
15 Lucida Lyræ. Vultur cadens.	15. à Seat 55, 30 $\frac{2}{3}$ '. à Spica 9, 20 $\frac{1}{2}$ '.
16 Aquilæ lucida. Vultur Volans.	16. à lucida Lyræ 34, 9'. à cauda cygni 38, 4 $\frac{1}{3}$ '.
17 Lucida in cauda Cygni.	17. à lucida Lyræ 23, 52'. à Seat 32, 57 $\frac{1}{2}$ '.
18 Lucida in crure dextro Pegasi.	18. ab algenib 20, 37'. à lucida cath. Cassiepeïæ 22, 4'.
19 Alæ Pegasi ultima.	19. à latere Persei 51, 45 $\frac{1}{2}$ '.
20 Persei lucidum latus.	20. ab Oculo tauri 36, 20 $\frac{1}{3}$ '.
21 Cauda Leonis.	21. à Spica 35, 2 $\frac{1}{2}$ '.
22 Os Piscis australis.	22. o.
23 Canopus.	23. o.

CANON PRÆCIPUARUM ESTELLIS FIXIS SECUNDUM OBSERVATA MAJORUM.

θ. Octo Fixarum nobilium declinationes ex curis antiquis, consulto etiam illustri Braheo.

	<i>Timocharidi.</i> <i>ante Chr. 295.</i>	<i>Hipparcho.</i> <i>a. Chr. 128.</i>	<i>Ptolemæo.</i> <i>Chr. 137.</i>	<i>Tychoni.</i> <i>Chr. 1600.</i>
4. Oculus Tauri.	8, 45 ^b .	9, 45 ^b .	11, 0 ^b .	15, 38 ^b .
a. 6. Capella.	— — — — —	40, 24 ^b .	41, 10 ^b .	25, 28 ² ₃ .
8. Sirius.	— 15, 20 ^m .	16, 0 ^m .	16, 45 ^m .	16, 11 ^m .
β. 10. Regulus.	— 21, 20 ^b .	20, 40 ^b .	19, 50 ^b .	13, 53 ¹ ₂ .
γ. 11. Spica.	— — — 1, 24 ^b .	0, 36 ^b .	0, 36 ^m .	9, 1 ^m .
12. Arcturus.	— 31, 30 ^b .	31, 0 ^b .	29, 50 ^b .	21, 18 ¹ ₂ .
13. Antares.	— 18, 20 ^m .	19, 0 ^m .	20, 25 ^m .	25, 26 ^m .
16. Aquilæ lucida.	5, 48 ^b .	5, 48 ^b .	5, 50 ^b .	7, 54 ^b .

a. Aristyllo circa an. 300, ante Chr. Capellæ declin. 40, 0^b.

β. Hipparcho ante Chr. 128. Reguli longit. ☉. 29, 50^b.

γ. Timocharidi ante Chr. 295. Spicæ longit. ♄. 22, 20^b.

ante Chr. 283. Spicæ longit. ♄. 22, 30^b.

Hipparcho ante Chr. 128. Spicæ longit. ♄. 24, 0.

Menelao anno Chr. 97. Spicæ longit. ♄. 25, 45.

Spicæ Declin. 0, 40^m.

☿. Dein Albatanio, Chr. 879. Reguli longit. ☿. 14^b, 0. Spatio itaq; annorum 742. grad. 11. 50'. aut potius gr. 11, 30'. propter Reguli longit. Ptolemaicam ☿ 2, 30'; non 2, 10'. sicut olim legerat Astronomus Raccensis.

Oculi Tauri Longitudo.
Anno Christi.

Hermeti. 25, 17'. ♄.

Hipparcho. 10, 0. ♄.

140. Ptolemæo. 12, 40.

851. Abomasaro. 19, 15.

831. Thabeto. 21, 17.

Arzachel. 23, 20.

Albatanio. 24, 30.

R. Grostetio. 28, 40.

1316. W. Eveshamio. 29, 0.

Addit Fixarum Longitudinibus,
Ptolemaicis gr. anno Christi

Alphonfus. 17, 8'. 1303.

Wymundus. 15, 52'. 1320.

Walterus Vig. 19, 5'. 1440.

Prima arietis distat ab æquinoctio verno gr. 25, 40.

Hic omnia Walterus Vigornien-
sis Cod. 13. inter Digbianos.

Progrediuntur autem Stella Fixa gradum unum annis solaribus.

1. Hipparcho, Ptolemæo, Theoni, Proclo, & Alfergano. ——— 100.
2. Timocharidi Alexandrino, qui observarat spicam cælestem annis Nabon. 454 & 466. Abdorahmano Salehio, & D. Petavio. 072 five ^{60 12}₁₀ & 50" quovis anno.
3. Johannidæ Ægyptio, Canonum Hacimicorum conditori ——— 70¹/₄.
4. Jahiæ f. Abomanfori, aliisque Probatae, quam vocarunt, }
Astronomiæ auctoribus: necnon Nasirodino Tufio, Cot- }
bodino Sirasio, Ologbeco Mogolorum domino, Xachol- } 70. & 51", 26"
gio, Abolphetacho, Abenesdræ, Maimonidæ, & ple- }
risque juniorum. }
5. Chryfococæ in Perficis, & Astron. Anglicis an. Chr. 1300. 68 & 52", 23".
6. Astronomis plerisque Arabum sub Mamone principe ——— 66²/₃.
7. Abdorahmano Sophio, Bahodino Chorcio, Alphonso }
regi, Albatanio ex Racca, quæ est Callinicos Mesotopo- } 66 & 54", 33"
tamiæ, Abdogalilo Segazio, Levi & Zacuto Judæis, & }
Observatorum Maragensium nonnullis. }
8. Copernico, Mæstlino, aliisque fide illorum --fere 71. & 50", 12", 5".
9. Nonnullis apud Chorcium Arabem. ——— 54.
10. Tychoni Braheo, Keplero, Bullialdo, ex obliquitate Zod. gr. 23¹/₂ 7⁷/₁₂ & 51".
11. Longomontano. ——— 72¹/₃ & 49", 54".
12. Gassendo. ——— 70¹/₃ & 51", 19", 24".
13. Ricciolo in Astr. Reformata, ex obliq. Zod. gr. 23, 30', 20". 71, 19¹/₂ d. 50", 40".
14. Nobis, & Ægyptiorum Hierophantis. 71, 9²/₃, mens. & 50", 9"¹/₄. fere.

*An Abstract of a Letter from Liege concerning a
strange preservation of four Men in a Mine 24
days without any food, April 9. 84.*

Some Colliers working in a *Cole-Pit* at *Herstol* about half a League from *Lige* on our *Shrove Munday Feb. 2* betwixt 7 and 8 in the morning, one of them peirced a *veine* of *water*, which gushing in violently drowned one, those that were near the mouth of the Pit were drawn out, but four of them being further within saved themselves upon a little ascent within the *Mine*, which has several *Lanes* or *Allies* in it, and were shut in by the *water* which stopt their passage out. 24 days were spent in drawing off the *water*, rather to render the *mine* useful again then out of any hopes of saving the men: at last on *Thursday* March the 9th. being the 25th of their confinement, *men* entred in, found these 4 alive, and drew them out and I my self among many others saw and examined them about these *particulars*: they had not a morsel of Bread with them, but lived on the *water* of a little *Fountain* which broke out by them: 2 *bottle* of which I caused to be *evaporated* to see if it were any thing extraordinary, and found nothing but a scarce perceptible *Calx* remaining.

Extract of a Letter of Mr. Heathcott to Mr. Flamsteed from Cabo Cors Castle on the Coast of Guiney the 14th of December 1683. concerning the Tide on that Coast, Variation of the Needle, &c.

THe Sea runs here along the shore continually to the Eastward, at a very great Rate, except at full and change, for then it runs to Westward, or at least makes a great Abate. November 24th. I took the time of the High-water at the Castle (as near as I could) at 3 h. 30' p. m. It flowed about 6 foot. The Magnetical Variation here is $3^{\circ} 49'$ from the North to the Westward. At my first Arrival I fixt my Weather-Glass, and found the *Argentum vivum* to Ascend 29 Inches, and in a Tornado 29 $\frac{1}{10}$ Inches: But a Stranger by Accident broke the Cane, so that I could make no further tryal, &c.

Martini Lister M. D. e. S. R. Lond. de *FONTIBUS
MEDICATIS* Angliæ, *Exercitatio altera*. Lon-
dini in *Octav.* 1684.

I Formerly gave an Account to this Society, of the first Exercitation I published of the Medical Waters of *Sparvs* of *England*; what I have since added to the second Edition of that Exercitation, I have already discoursed in a Paper to this Society. As the Examination of all the *Inland* salt Springs, or Brine Pits called *Wiches*; also concerning the specifical difference of Sea salt from the Salt of those *Inland* Brine Pits, &c.

I shall proceed to entertain you with a short Account of the 2^d. Exercitation, now first published, of the Medicinal uses of the said Waters.

And because I could not well be understood when I had occasion to reason of Physicall Matters, unless I premised my own thoughts (how true I leave it to others to judge) and for that the main business of health and sickness seemed to me to depend most upon the due concoction of meat in the Stomach, and the good and bad condition of the humours of the Body resulting there from; I have thought it sufficient to explain my self upon these matters; There being (in my Opinion) little else required, to account for all the *Phænomena* of health and sickness, and the right application of Medicines.

Concoction I have explained by Putrification, for that I see no cause to think the change and resolution of meats and drinks to be differently made in the stomach of Animals, from what they are in the open Air; because the capacity of the Stomach and Guts, are verily an other outside of them. The Tabefaction of meat and drink is only therein hastned, and sooner performed; as, for example Wine or Beer, which do not fower of themselves of some time

time in the open Air, do yet turn to meer Vinegar in the Stomach in a trice; and so it is to be understood of the speedy rotting of more solid meats therein.

I have confirmed this Doctrine with many other Arguments, which I refer too, to the Treatise it self.

Now because meats that putrifie, whether of the Herb kind, or of Fish or Flesh, do all therefore abound with volatil and urinous Salt; it is necessary that this Chyle in like manner should be salt: And as it is the great business of Nature, on the one hand, by the *Lactææ*, to clear the Chyle of the filth of the grosser Excrements; so, after its admission into the habit of the Body, to purge it still of this necessary evil, *viz.* the urinous Salt, by the Kidnies.

That the Chyle is attracted and sucked into the habit of the Body by the *Lactææ*; which are the only true mouths of the Body.

That the Chyle first looses its Opacity and whiteness, and becomes limpid in the blood Veins.

That the limpid *Serum* is the old Chyle; which is not distinct from the *Lympha*.

That the *Lympha* or *Serum* is ever a humour totally distinct from the red part of the blood, which turns grumous when cold.

That from those two primary humours, all the other secreted humours of the Body are made.

As from the red grumous Blood, Choller alone: From the new Chyle, Urine. From the same a little cleansed, Milk: from the *Lympha*, Spittle: from the most pure *Lympha*, the genital humour.

That the cause of secretion is the Pulse: its manner is explained by a magnetic Attraction which each secreted humour hath of its like; also the suction of the secretory Vessel.

fels is asserted ; which we think as reasonable to insist on, for the *Exit* of the humours, as to the *Lactea* for the *Entrance* of the Chyle into the Body : both the *Lactea* and all the secretory Vessels being from capillary beginnings not unlike, enlarged in their progress, these outwards, and those inwards.

That the secretion of the Urine is made, at the same time, with the separation of the *Lympha* ; both participating of the same colour, if the *Serum* of the Blood shall chance to be vitiated.

That the rest of the humours, as the *Pituita*, Milk, the Genital Humour, are never coloured tho vitiated ; because they undergo a third secretion at the least.

That the secretion of Choler is very slow ; and for that purpose the Blood is circulated through the Liver by veins only ; and this ought to be so, because the red Blood, from which only it is separated, is not much, herhaps, scarce as $\frac{1}{12}$; and likewise consists of very thick and heavy parts, which therefore seem to require more time in the separation ; and altho the secretory Vessels in the Liver are very numerous, yet, where they joyn, the common *Ductus* is narrow, and very disproportionate.

On the other hand the *Pituita* is thin, and hath many *Exits*, and infinite Vessels to purge it ; as being separated from the great Mass of the *Lympha* or *Serum* in the Veins.

Thus much as to the humours in a natural and healthful State : The humours are thus understood to be vitiated.

That the *Pituita* springing out from innumerate fountains in the Mouth, Stomach and Guts ; also the Choler in the *Duodenum* from its there inserted Orifice ; because they are still carryed on farther in the Guts, do often re-enter the Body by the *Lactea*, weakened upon any Occasion.

Whenever this readmission of Choler and *Pituita* happens by the *Lactææ* (which it does in most Diseases) we are then sick; the Primary and radical Humours of the Body being contaminated with their own Excrements; which had been once expelled.

So that the Antients are best understood in this sense, when they tell us, that *Pituita* causes cold Diseases, and Choler, hot ones: that is, the extraneous *Pituita* and Choler readmitted; not that the habit of the Body did abound with them, or breed them now in greater quantities; but instead of a total ejection, the evil guests steal in again, and Nature labours as it was in vain.

That the Chyle it self too, is often in fault, and is to be reckoned amongst the vitiating Humours, *viz.* where it is too plentiful from much feeding; or made of Aliments, that rot not kindly in the Stomach; this also is to be ejected as supervacaneous.

From these few things the symptoms of most Diseases are very easily to be accounted for; As the various affections of the *Urine*, the Spittle, Sweat, &c. Why it is bilious, and sometimes pale and thick, &c. Why this is naturally sweet and thin; sometimes acid and saltish; and and sometimes thick like *pus*; &c. and the like, *viz.* according as this or that humour shall be mixt Crude and superfluous, Chyle or extraneous Choler and *Pituita* readmitted, or with the red blood it self. Hence also true Indications may be taken for the cure of Diseases; and the known vertues of simple Medicaments, according as they have been delivered to us by the Antients, more certainly applied; because these notions come nearest their doctrine, and consequently will more facilitate a practice deduced therefrom. This Doctrine I have also illustrated with some few cases in Physic; see the Treatise.

A Theory of Health and Diseases being briefly laid down, as they relate to the humours; we proceed to enumerate

the

the known effects of our *Spaw* Waters : concerning the particulars, see also the Treatise.

This also being dispatcht ; the natures and properties of each Ingredient is propos'd to be examined : And because nothing is new therein, which the Antients have not well accounted for, but the growing Salts of the Niter of Limestone, and abortive Vitriol, we insist chiefly upon the examination of these two.

And affirm, as the perpetual properties of them, that they two alone, of all the Minerals in Nature, every where petrify, as well as within our Bodies, as without us ; and that it will be hard to find a third thing in nature that does so.

That Petrification is best explained by Magnetism : and that as Iron toucht with a solution of blew Vitriol immediately attracts the Copper and firmly petrifies upon it ; so do the teeth of some men (the only naturally naked bones of the body) attract the abovesaid petrifying juices contained in meats and drinks. But of this I purpose to discourse elsewhere more at large.

That these two Lapidiscent Juices of the *Spaw* Waters are the only efficient, and in good part the material Causes too of the Stone in Man and other Animals ; crude humours, being occasionally more or less implicated, as they more or less abound in bodies, and wrapped up in the coition of the Lapidiscent Juices ; which thing Holly Wood does well illustrate ; it being observed above any sort of wood, most inclined to petrification ; because of its abounding with a *viscous Humour* ; which is the Birdlime in use.

And because it may be objected, that many are troubled with the stone, and but few that drink of the *Spaw* waters ; I answer, that in this sense, all waters are *Spaws*. but much more such as are so denominated : as all the well waters of this City, and *England* do testify, and therefore no man upon this account is free from the Stone ; and whoever shall

attentively examine the Urine of Mankind, will find none free; unless the strumous and gouty; of which more I design elsewhere.

The Examination of *Van Helmont's* Doctrine about the Stone; and the Arguments for this which I have laid down, I omit, and refer to the Treatise.

If Iron be in the calcined *Calculus Humanus* the Loadstone, if carefully applyed, will extract it, and demonstrate it to us; as, in truth, it hath often done, when I have applyed it for that purpose: And if Limestone, the Calcination also is necessary; because otherwise the Fat will hinder the Acids to work on it; but a calcined bone will wholly be dissolved by any Acid.

Having dispatcht these things, we come to the Medicinal uses of the *Spaw Waters* in *England*; which we examine upon the Doctrines of other Writers of our English *Spaws*; viz. choosing out the particulars wherein they mostly agree.

As *Hypochondriac* Melancholy; an ill habit of body from any chronical Disease, as long Agues, the Scurvy, &c. The stone of the Kidnies and Bladder; the Gout, Worms, Barrenness of Women, &c.

The excellency of the waters in the first case is deduced at large, from the cause of that disease; which we take to be, too great a fullness of Chyle. That they are less fit, and not to be given to cachectic people, without great Caution and Advise: that they are not to be used in the Stone and Gout, which two Diseases they can no ways help, but by accident: the reason of the Gout being from a stop and dejection or coition of some stony Particles upon the Membranes of the bones in the more narrow passages of the Joynts

That Steel hath been of old noted as infamous for causing barrenness in women: which ill Character of that Medicine I doubt is almost forgot in this Age; and that therefore

therefore *abortive* Vitriol (the grand Ingredient of atramentous Waters) ought to be much more suspected in that case. Altho the natural hot Waters, outwardly used in *Baths*, have been, by the same antient Authors, as much famed for the contrary good effect upon women

The use of Oyntments before and after Bathing to be brought into use again : and the debauch of staying long in the hot waters, as it is now practised with us, to be avoided, &c.

*Nonvelle Maniere de Fortifier les places par Monsieur
Blondel, &c. a la Haye, 1684.*

THE *Author* having considered the *Art of Fortification* as it is at present practised, finds it not to have received proportionable improvements to the *Art of Attacquiring*. This appears sufficiently in the success of the *K. of France*, who usually makes himself master of these *Towns* in 10 days, which formerly were held capable of resisting as many *Months*. There is therefore laid down a new way of *Fortification*, which may take away from the *Besiegers*, the advantages they draw from their number of *Men* and *Cannon*; and give the *Besieged* room for the making use of more *Cannon*, and supplying the want of men. This is principally done by a vast enlargement of the *Flanks*, and *Demigorges* so as to be capable of three very large *Batteries* one over another, and sometimes a *Carvalier* at top, all which in some *Figures* may hold 100 or 120 *Cannon*, sufficient to dismount any *Battery* that may be raised on the *Contrescarp*. For the better explaining the *Work*, there are 12 *Tables* added. The 1. is to shew the practise upon all sorts of *Angles of Poligons* given, the 2. 3. 4. and 5. contain part of several sorts of *Poligons* fortified after this method. The 6th. is the *Plane* of a *Tenaille* made large, and representing exactly all the parts of this *Fortification*. The 7th. is the same *Plane* with its *profile*. The 8th. is a *Table* for calculating the *Angles* in several *Poligons* fortified after this manner. The 9th. is a *Table* for calculating the lines in the same *Poligons*. The 10th.

10th. is to shew the easiness there is in reducing other *Fortifications* (provided they have second *Flancs*) to this manner, without altering the *Face* of the *Bastion*, the *Motes*, or the *Outworks*. The 11th. is the *Plane* of the City of *Dunkirk*, with the *Antient Fortifications*, upon which are placed also the *new ones* (of the *Author*) that both *Methods* may be the better compared together. The 12th. is a *Plane* of the City of *Mastricht* and its *old Fortifications* but reform'd after this *new manner*.

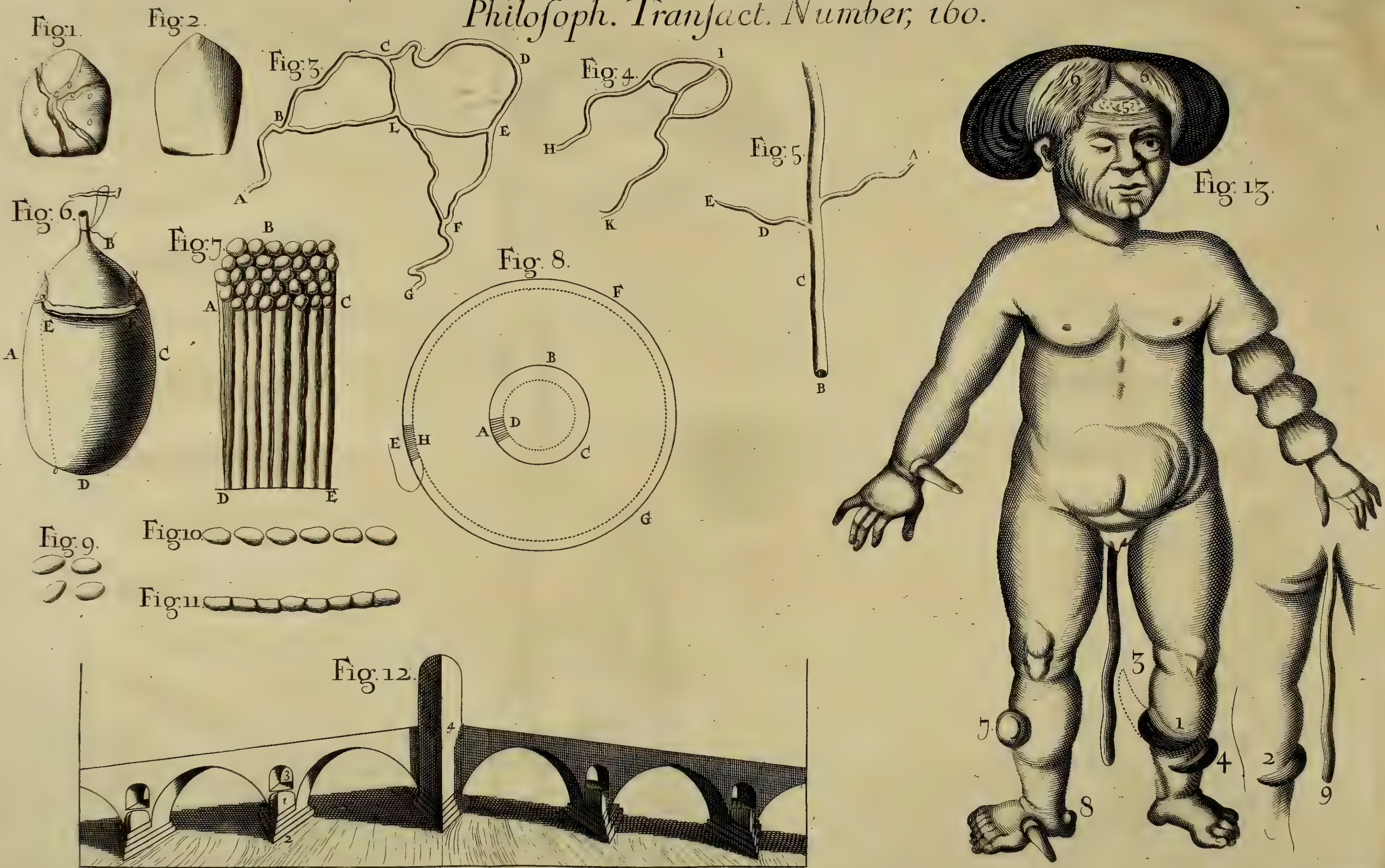
Advertisement.

The *Breviat* of this *Book* is not mention'd in the *Contents*, because it was thought at the time when the first sheet was printing, the preceding *Discourses* would have been sufficient for the *Quantity* of paper usually allow'd for each of these *Traëts*.

OXFORD,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON. 1684.





PHILOSOPHICAL

TRANSACTIONS.

June 20. 1684.

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*A Letter from Mr. Tankred Robinson to Dr. M. L.
Aug. 4. 1683. concerning the Bridge at St. Esprit
in France.*

According to your Order, I made as many Observations upon the Fabrick, and design of the Bridge at *Pont St. Esprit*, as my short stay there would permit; I sent you a Draught and Description, drawn hastily upon the place, peradventure you can make nothing of them, unless assisted by your own Memory.

This famous *Roman* Bridge at *Pont St. Esprit* is very crooked, bowing in many places, and making several unequal Angles, especially in those places, where the Torrent runs strongest, as where the Turret stands *F. 12. N. 4.* In which place the Angle is most unequal, and the greatest; the Arches are very wide, and have their feet secured by two Pedestals that encompass them. Both these Pedestals have their several degrees, or Ranks of jettings out, like so many rows of stairs or steps, the lowermost order pushing out most, the others being less, and going gradually more in; the second or uppermost Pedestal is much less than the first, or lowermost, being built a little within its lines of circumference, see *N. 1, 2.* between the great Arches there are windows, or (as it were) small Arches, *N. 3.* that come down to the very plane of the second, or uppermost Pedestal, dividing the feet of the great Arches. From this my rude Description it appears to me, that the *Romans* have here contriv'd all possible ways to break gradually the mighty force of the Rhosne, and to render its passage easy, and inoffensive to the feet of the great Arches; for here we see so many several Palisadoes and Sluces, as may be sufficient to defend this wonderful Fabrick against all storms of the Torrent; The several ranks of stairs jetting from the Pedestals
(for

(for the most part triangularly built, and fac'd well with free-stone) opposing, and breaking the stream severally, I mean, not altogether, or at the same time, by reason of their various inequalities in standing out: in case the flood should swell so high (as it frequently does) as to cover both the Pedestals, then the small Arches dividing the feet of the great ones N. 3. help to convey the water through, which otherwise might endanger the great Arches. This Sir, is all I conceive at present, I mean as to the superficial design, whether there is any particular Architecture within the Pedestals, or at the feet of the Arches within them, or in the general fabric of the Bridge itself, I cannot tell; no body being able to inform me: or whether the *Romans* had some peculiar Cements not known to us.

A Remark about the foregoing Letter by Dr. M. L.

Note that what seems the foot of the Arch, is an *Horizontal Arch* gradually contracted, every stone being of vast length and wedge like, laid level with the water. This I speak by memory, and in this particular I did most desire to be satisfied, because it might be of great use and advantage in building our Bridges in *Yorkshire*, whose streams are mostly Torrents, as the *Rhosne* is the greatest in *Christendome*, and ours mostly as that have rocky bottoms, which will not admit of Piles driving in.

An Abstract of a Letter from Mr. A. Leevvenhoeck of Delft, dated Decemb. 28th, 1683. concerning Scales within the mouth, the scaly Child that was shewn, the Anatomy of the Slime within the Guts, and the use thereof.

IN my Letter of the 17th, September 1683. I said that our Skin was covered with Scales. I have since that time examined the *Cuticula* of the inside of the Mouth, and chiefly that of the under Lip; which I find to be covered with *Scales*, greater and broader than those upon the Body; but they are withal thinner. *Fig. 1.* is a *Scale* which I choose out as one of the perfectest and most intricate. These *Scales* had more lines or streaks running over them, than the *Scales* had which grew on the outside of the Body, the lines I take to be channels or remainders of vapours breathed thro the Skin. Every *Scale* also had a great many small Globules upon it, very transparent, as is to be seen in the *Figure*.

Another *Scale* lying thereby, had its circumference as *Fig. 2.* But as the *Scales* of our Body, lying over one another, so as to be three deep, are the cause of the skins appearing white, as I have formerly said (for diaphanous Particles laid upon one another, and not too close, make a white; for which reason we see that *Paper*, *Spittle*, *beaten-Glass*, and *Snow* are white): so the *Scales* of our Mouth, (for as much as I can yet find) lying but a little over the sides of one another, suffer the redness of the flesh and blood to appear through them; and for this cause the Lips and Mouth are red.

I have often wondred what should be the cause; that a single hair lying upon the skin caused so great a tickling! But if the Skin be covered with *Scales*, and the outward bark of the hair be very rugged, it will not be strange,

strange, that a hair lying over the edges of one or more *Scales*, should cause a motion in them, which being communicated to the skin, may cause that sensation.

There has been carryed thro this Land to be show'd, a *Child* about ten years old, whose Body (as they said) was all covered with *Fish Scales*. Having heard very much of this wonder, I went to see it, but found it much different from the Report of it. For there appeared to my naked Eye and Microscope, no part of the Body which I could say was covered with *Fish Scales*, but rather with a thick *Callus*, and more especially within the hands and under the feet; upon some parts of the Body also there were Excrescencies like Ridges of *Warts*.

I desired of those that took care of the *Child*, that I might have one of the Particles, or *Scales* pluckt from the Body, but they refused me, under pretence that the blood would follow it, when I lookt earnestly upon the *Child*, I perceived they were displeased with me; they told me, that the *Scales* fell off four times a year, and others grew in their places: and that daily some of the *Scales* were left in the bed, but they still refused to give me, or sell me any of them; at length in searching carefully about the Room I found a Cluster, which my repeated Observations do confirm to be nothing but natural and ordinary *Scales*, such as bodies use to be covered with. I afterwards put it in water. and let it lye some hours, till the parts would separate with the least touch into a thousand small *Scales*. These were more then ordinarily beset with Globules, and thereby were very like the *Scales* of the Brawn of the inside of the hand. But no otherwise remarkable.

I have been a long time desirous to examine the slimy matter which lines the inside of the Guts, and so much the rather because it is generally esteemed as a superfluous part, and fit to be removed: whereas on the contrary, it appears to me, to be a part instrumental, and necessary

cessary for the uses of the Bowels. I took then this woolly substance, and having cleared it from the Excrement, as much as I could, I found a great number of very thin blood Vessels branched out, and lying so thick together, that the space of half the Diameter of a hair was not void between the branches. Besides the blood-vessels, there were also other vessels that had no distinguishable colour, which I suspected to be Lymphatics or Lacteals: I could not discern any Membrane that encompassed them, but all about them lay a glutinous clear slime, beset with small Globules, which slime and Globules I took to be the Excrements lying upon the Guts, but when I went to scrape gently this slime away, I found that I not only wounded the bloodvessels, but tore away many blood-vessels, and other vessels together.

These blood-vessels do not spread their Branches on all sides, like the blood-vessels in other parts of the body, but as they lye in a Bow, send all their Branches inward, and none outwards: They also lye so close by one another, that I imagine ten thousand of them may be in the space of an inch square; I have described the circumference of one of these vessels in *Fig. 3. A. B. C. D. E. F. G.* which circumference is no greater then to be covered with a sand: The thickness or Diameter is about the 25th. part of a hair of my head, from the inside many small vessels issuing out doe as it were joyn together, but of these only 4 are specified as in *Fig. 3. B. L. E. and C. L. F.*

Fig. 4. H. I. K. is a small vessel, and though I have placed it at some distance from the former, nevertheless it was partly covered by it, as is usual with the rest of them to cover one another: The Bows also lye all the same way, bending towards the passage of the Excrement out of the Guts.

I could not track *H. G.* and *H. K.* any further, by reason

reason that they hid themselves among the other parts of the woolly substances.

From the foregoing Observation, I have been doubtful whether the Arteries and Veins were not in this place joined together, *viz.* whether *A.* were not an Artery, and *G.* a Vein, for among all the Experience that I have had of the blood-vessels I never perceived such a probability of an *Anastomosis*. For in other places the Arteries being variously disseminated for the nourishment of the parts, the veins are so likewise, for the carrying the blood back again into the heart: but in this place the Arteries going no further than the hollow of the Guts, seem to have no other business then to empty themselves into the Veins.

These observations also make me more then ever reject the Opinion, that the Extremities of the Lacteal and Limphatick Vessels have mouths or openings, whereby they receive and take in the Chyle out of the Guts, for I am persuaded that the extremities of the *Lactææ* in the Guts are as well covered with their Coat or Membrane in that place, as in other parts of the body, which nevertheless will not hinder the food from passing out of the Guts. For let *Fig. 5. A. B. C. D. E.* be the root of a tree, the nourishment that this Root receives out of the Earth, shall pass no easier thro the Extremities *A.* and *E.* than thro any other place about *D.* or *C.* which is of the same bigness. For example, I have seen the small Roots of a Vine an hundred times thinner than an hair of my head, their farther ends *A.* and *E.* take up a place of the one thousand part of the bigness of a sand. Now if a place be no bigger than this, the moisture or nourishment of the Tree, will as well pass thro any part of the Bark or wood of the Root, as thro the places *A. E.* So that a thin capillary Root may as well receive the nourishment at any other place as at the end. And as the Arteries, whose Coats are made up of a threddy substance, can strain the blood thro them,

(as

(as I have formerly said) so the nutritive Juice also may pass thro the threddy Coats of the blood, water, and milk-vessels: and in the same manner, the small Branches of the veins may take up substances out of the Bowels, and carry them to the heart.

This will not seem strange when we consider, that if a milk, water, or blood-vessel, be a thousand times less than a hair of ones head, the Coats of them must needs be very thin, and the threds whereof the Coats are made yet thinner. How easy must moisture pass thro the sides of such Vessels; especially when the matter which is to enter into the vessels is thinner than that which is already contained in them.

It has been objected, that while the passage into the Vessels is so open, a quantity of Air and Wind may also get into them. Now that you may see how that the moisture may pass out of the Bowels into the Veins, and the wind not pass, I made this following tryal. I took an Ox Bladder, blew it up, and let it dry as *Figure 6. A. B. C. D.* I then took a piece of a Hog's Gut made clean, about the length of a span, and tied it up at *E.* then I put into it water, till the Gut was about a quarter full: Afterwards I forced in three quarters more of Air, binding it fast at *F.* the Gut then lay upon the Bladder as *E. F.* I then hung them in a Chimney where was made but little fire, and I found that the water in the Gut did not only moisten the Bladder, where it touched it, but run down in two Channels by the side of the bladder; in the space of sixteen hours all the moisture in the Gut was run out, without the least Air, nay the Gut seemed as stiff, as when it was first blown.

Let us now compare the Guts to the Bladder, and the Chyle and Wind in the Guts, to the wind and water in the hogs gut, then shall the Guts let the moisture pass through them, but not the Air.

Among the aforesaid blood-vessels and other vessels lying

lying within the Guts, I saw a matter seeming first to consist of Globules. Afterwards it appeared like little Guts within the great Guts: at length it proved to be short threds, whose one end was partly covered with the aforesaid vessels, and the other end was fast'ned to a Skin or Membrane, probably the same with that called by the Anatomists the inner-most Coat of the Bowels.

Fig. 7. *A. B. C.* are the ends of the threddy substance, otherwise called the slime or woolly substance, which I shall now name the inner-most Muscle of the Bowels, their Appearance (if the blood-vessels be removed) is as in the *Figure*; the threds making the inward Muscle of the bowels, if they be lookt on, on one side are as *A. D. E. C.* the thickness of these threds, is less than a hair of my head: they are very tender, and break upon the least touch: I have sometimes thought that each of these threds consisted of several threds joyned together, or that every thred had a Membrane; for all of them seem to be very close linked together.

This woolly substance (which I have described) I conceive may be of great use; for the threds must be longer, and lye closer together, and have little moisture betwixt them, whilst the Gut is empty and crumpled; but when the gut is full and distended with Victuals, the threds must be shorter, and lye not so close together as when the gut is contracted. By which means, the blood-vessels *Lacteals* and *Lymphaticks* come more easie to receive their liquors into them. For example,

Let us imagine that in the *Fig. 8.* *A. B. C.* is a gut cut across as it is empty and shrunk; that *A. D.* are the threds making the innermost Muscle of the Gut, now if the gut be full and stretched to the wideness of *E. F. G.* the threds *A. D.* will be contracted as *E. H.* not only because they are close compacted together, as they lye among one another, but also because the blood-vessels and other vessels running between them, keep them as

it were bound up : for if they were separated from one another, then would the groffer parts of the Excrements get among them, as often as the Bowels are extended. Now the threds not being crowded so much when the guts are stretched, the Chyle enters more easily into the vessels lying among them, and afterwards upon every Contraction of the guts (because then the threds are squeezed together) is conveyed into the body.

I said before that the threds which make the innermost Muscle of the Bowels, lye with their one end in the hollow of the Bowels, which end is for the most part covered with blood-vessels and other vessels. Their other end is fastened to a Skin or Membrane which probably is taken by Anatomists for the Innermost Coat of the Bowels, as in the line *D. E. Fig. 7.* may be seen. In this Membrane I discovered many Globules of fat, which in some places lay close and crowded together, and therefore appeared in different shapes. In other places lay some fat Particles, at a distance from the rest, these all inclined to an oval shape as *Fig. 9.* In another place a little distant lay ovallish Particles in a right line, as *Fig. 10.* In another place the Particles lay so thick together, that they crowded one another, and appeared as in *Fig. 11.*

A Letter formerly written to Mr. H. O. containing the Projection of the Threds of Spiders, and Bees breeding in cases made of Leaves, as also, a Viviparous Fly, &c. by Dr. M. Lister.

I am glad to understand my Letter came safe to your Hands. Give me leave to entertain you now about the Subject of *Insects*, which I see by your last *Phil. transf. Num. 65.* many persons are now curious in.
And

And not to go out of that Tract, I take the forking of some *Threds* (for the Doctor excepts the most) to be merely accidental, even as it is to our *Hair*, neither do I think that any such thing is designedly done by the *Animal*: and, for as much as I have observed, *Spiders threds* of themselves are exceeding slick and smooth, and this was not unobserved by the Antients: *Pliny* in the praise of Italian *Linnen* says, *Rectovinis summa tenuitas, nulla lanugo, nervositas filo aequalior pene quam Araneis*. There is, indeed, a dividing in the projection of the *Threds* of many sorts of *Spiders*, and especially among those which we distinguish by the name of *Lupi*, which tribe is most frequent and particularly delighted in sailing, yet this dividing is much of another nature than Forking. These *Lupi* will dart a whole *Stamen* or sheaf at once, consisting of many *Filaments* yet all of one length, all divided each from the other and distinct, until some chance either snap them off, or entangle them; but for the most part, you may observe, that the longer they grow, the more they spread and appear to a diligent observer like the numerous Rays in the tail of a blazing Star. As for that which carries them away in the *Air* so swift off hand, it is, as I formerly hinted, partly their sudden leap, and partly the length and number of the *Threds* projected, the stream of the *Air* and *Wind* beating more forceably upon them, and thus we see a Rope that unexpectedly slips, comes home with a seeming violence, and partly (and that much too) the posture and management of their *Feet*, which, at least by some sorts of them, I have observed to have been used very like *Wings* or Oars, the several legs (like our fingers) being sometimes close joyned and other times opened, again bent or extended, &c. according to the several necessities and will of the sailer. To fly they cannot strictly be said, they being carried into the *Air* by external force; but they can, in case the wind suffer them, steer their Course, and perhaps mount and

descend at pleasure : and to the purpose of *rowing* themselves along the Air, 'tis observable, that they ever take their *flight backwards*, that is, their head looking a contrary way, like a Sculler upon the Thames. It is scarce credible to what height they will *mount*, which yet is precisely true, and a thing easily to be observed by one that shall fix his Eye some time on any part of the Heavens, the white *Webbs* at a vast distance very distinctly appearing from the Azure Sky : but this is in *Autumn* only, and that in very fair and calm weather, for in wind they delight as little (if possible) for them to mount, as for the *Indians* in *Pliny* to fight a battle with their Reed Arrows. Divers sorts have divers ways and particularities in performing this surprizing *Phænomenon*. I am not willing to hasten a History which further leisure may improve, yet partly to excite the curious, and partly to satisfy the promise I made in my former printed *Letter*, you may command from me, when you please, a set of general *Enquiries* on this subject of *Spiders*, most of them already answered by me, &c. founded upon new discoveries.

The Account given of the *Bees* breeding in *Cases* made of *Leaves*, *Phil Transf.* Numb. 65. exactly agrees with what I have observed. I add, that they are not very scrupulous in the choice of those *Leaves*, but will make use even of exotick Plants, such as the *blew Pipe* or *Syringe Tree*. There is a very strange *Oeconomy* of nature yet unsolved : The furthestmost *Bee*, says *Mr. Willughby*, makes her way out along the *Channel* through all the intermediate Cartrages : and according as these Channels run upwards or downwards in the body of the Tree, the *Maggot Bee* at the far or upper end of each *Channel* is first laid, and it should seem both *hatched* and perfected first, and must either wait until the rest be so too, or of necessity by working through their *Cases* destroy them. If it be so, it is very strange. But I take it otherwise, and perhaps it will be found by diligent observers hereafter, that

that that *Bee* which is nearest day, although it be last laid, is yet the first *hatched*; and I ground my Conjecture upon this, that 'tis probable, that the *Eggs* in the Mother are all fit for laying, or equally ripe and forward (as we say) at the time that the first of them was laid, but are not therefore all laid by the *Dam*, until she has provided them of *Meat* and a *House*, each *separately*, as is the nature of *Bees*: and yet in recompense, the warmth of her body, or rather the daily encreasing *Heat* of the Summer-season, to which the Mother *Bee* is continually exposed, whilst the first laid *Eggs* are sheltered in their deep *Channels*; hastens their Vitality so much, that they are *hatched Worms*, and begin to feed before the first laid, and consequently are first perfected into *Bees*. But this is conjecture only, and not observation, and to this purpose, let me observe to you, that we are not always without our *Viviporous Flies*, although in a much colder Region than *Italy*; The first time I took notice of them, was the 2^d. year of the Sickness raging in *Cambridge* 1666. I have of this sort some by me at present, which you may command, for I do not find them cut or described either in *Aldrovandus* or *Mouffet*, though this sort of *Fly* be very frequent with us. And this was not the only strange *Phænomenon*, that I observed among *Insects*, besides other things of nature, particularly that year: for being in Harvest-time at *Bessenburn in Cambridge-shire*, at the House of Mr. *W. A.* he invited me along with him into the Fields, where, Cozen, says he, I will shew you a wonder, which, indeed, was so to me, for lifting up the *Barly-Cocks* with his Cane, there appeared millions of *Maggots* on the Corn Lands, and in their *Barns* too, the *Floor* would be covered with them that fell from the Carts. The *Maggots* were about half an Inch long, no thicker than a Pigeon's feather, of a white colour

colour, somewhat shaded with an *Isabella* or faint yellowish stripes the length of the *Worm*; they had 14 feet, after the manner of many *Caterpillars*, and I was almost confident would have produced some sort of *Moath*. I took up about a score of them, and put them into a Box, but they immediately offended me with an ungrateful and strong stink, which yet is not usual to the *Caterpillar* kind. However I kept them 2 days, but by reason of some Apprehensions and fear the Ladies had of them, where I sojourned, and upon their intreaties I rid my self of them; I only observed, that the *Excrements* which they voyded, were little hard Pellets of pure white flower, like that of Barly. These and other things might be Arguments of the power hot weather hath in the hasty quickning the Births of *Insects*, as well as producing them; but I conceive it less useful to Philosophy to dispute, then to deliver faithfully matters of Fact.

December 23, 1770.

A Let.

*A Letter written to Mr. H. O. concerning some
very aged Persons in the North of England, by
Dr. M. L.*

Since my last to you I have been in *Craven*, where I was not unmindful of your Commands; but, indeed, I find it a very hard, and troublesome business to verifie precisely the *Ages* of such Persons, as either affirm themselves, or are believed very *Old*: the best Informations and Reports I could get I send you.

Robert Montgomery now being living in *Skipton*, but born in *Scotland*, tells me that he is 126 years of Age; the oldest persons in *Skipton* say, that they never knew him other than an old Man; he is exceedingly decayed of late, but yet goes about a begging; to which his debauchery (as is said) has brought him.

Mary Allison of *Thorlby* in the parish of *Skipton* dyed 1668, aged about 108. she spun a Web of linnen Cloath a year or two before she dyed, which as they say, the *Countess* of *Pembroke* keeps by her as a Rarity.

I. Sagar of *Burnley* in *Lancashire* about 10 miles off *Skipton*, dyed about the year 1668, and was of the Age (as is reported) of 112.

Tho. Wigger of *Carlton* in *Craven* dyed 1670, at the Age of 108 and odd months: he went about till within few weeks of his last, and was a very fair Corps. The Register of *Maladale* was looked over upon wagers, and this account (as is said) found true.

Frances Woodworth of *Carlton*, dyed 1662, of the Age of 102 and some odd months: the Mother of 7 Children, always a very lean woman, yet to her very last went about as streight and upright as a young Girl, and of perfect memory: her sight and hearing decayed, though not wholly deprived of either. This by Information

formation from her Son *Robert Woodworth* now living in *Carlton*, of the Age of 69, as able a man to ditch and plough as any in the Town.

William Garthrop and *William Baxter* of *Carlton* inform me, that they two being upon the Jury at *York* 1664. they saw and spake with in the Assize-Hall, two Men, Father and Son, summoned as Witnesses in some Cause or other out of *Dent*, a small Valley in *Craven* 8 miles beyond *Settle*, the Father told them, that he and his Son made twelvescore between them, that his Son was above 100 and that he wanted not half a year of 140. he told them further that he could and did make Fish-hooks as small as would take a Trout with a single hair. They observed that the Son looked much the older, and had the whiter hair, this Son he had by a second Wife: They could not remember the names of these Persons.

I add, that it is to be observed, that the Food of all this mountainous Country is exceeding coarse, as salted and dried Beef, and slower-leavened Oat bread.

I am confident many scores of persons might be found of the age of 100 years among these Northern Mountains, but 'tis troublesome to verifie, and you must not take these Reports as Authentick and exact; but yet credible enough, to make the matter worth the Examination.

March 17 1660.

The Description of a Monstrous Child, born Friday the 29th. of February 1684. at a Village called Heisagger, distant about 4 English miles from Hatterleben, a Town in South-Jutland, under the King of Denmark's Dominion, communicated by Mr. Christopher Krahe, a member of the Ecclesiastical Consistory and Provost of all the Churches belonging to the said Diocess.

THE Mother of this Child being married to a Soldier or Trooper of *Colonel Gamb's* Regiment, it is supposed she had seen some body wounded or disfigured in the same manner, as it doth appear at the Child's *Leg* or *Foot*. At the left *Leg* *Fig. 13. N. 1.* there was to be seen an oblong round piece of flesh of a brown and blew colour, at the extremities somewhat sharpened, which was joyned to the Calf of the Leg, *N.2.* and could be moved or put out and in from 1. to 3. that other piece of flesh 4. was of the same colour, but fastned to the Leg, so that it could not be displaced. At the right foot it hath 6 Toes, that *N. 7.* was like a *Bullet* of a Pistol, which did hang loosely to the Leg, *N. 8.* another Bullet somewhat bigger. The face did look pretty old, as if it had been of 35 or

40 years of age. N. 5. and 6. at the forehead there have been observed such Excrescencies as if it were artificial *Laces*: which the Painter, who 3 days after it was dead did draw the Scheme, testifieth to have been almost spoiled or rotten, by the touching of so many 100 of people that went to see this Creature. But before, when the head of the Child was turned against the light of the Sun, these physical laces seemed to be very artificially done. With the left Eye it did look fiercely, keeping that other close. Behind the head, there was a shape like a *Hood* or other Ornament, which women commonly do were. His *Arm* was figured like as the Scheme sheweth, with several knots or joynts. The *Tail*, which was strangely grown out of the back-part, N. 9. was a quarter of a *Sealandish* Ell long. The Mother of this Child being aged about 40 years, hath had formerly 2 other Sons, now of 7 and 9 years of Age, which are very well shaped and still alive: but this *Monster*, after it had cryed out 2 or 3 times, died presently.

Præclarissimo & Eruditissimo Viro D. Jacobo Spornio Medicinæ Doctori, & Lugdunensi Anatomico Acuratissimo. Marcellus Malpighius S. P.

Percunctanti tibi, Vir doctissime, ac eruditissime, num aliquid novi editis jam exercitationibus meis addendum superfit, cum Typographus, quem innuis, dictis opusculis novam paret lucem; responsum hoc erit, me pluribus & a re litteraria alienis distractum negotiis tandem conquiescere. Quoniam tamen quædam mihi in dictorum confirmationem occurrere, nonnulla quoque circa animalium viscera, quæ multis ab hinc annis (insectorum plantarumque anatomix addictus) ut cruda neglexeram, adhuc meam excitant phantasiâ; ideo cum novam ac solertiorem exigant indaginem, tibi communicanda duxi: utpote qui intima animalium viscera scrutando ulterioribus aggressionibus dilucidiora reddere, elegantiq; eruditione exornare præ reliquis valeas. Hæc itaque si tibi, Vir summe, ariserint, toti Reipublicæ litterariæ non displicuisse putabo.

Inter reliqua, quæ de externo tactus organo alias habui, nonnulla de ungulæ natura & generatione indicavi: quæ ut ulteriori fruantur luce, anatomica observatione veniunt. Duodecimus jam excurrit annus, quo mactandum bovem lustravi cum præclarissimis Viris *D. Carolo Fracarsato*, & *D. Silvestro Bonfiliolo*, a cujus collo in dextris, ubi jugum apponitur, insigne pendebat *Cornu*. Hujus longitudo decem & sex digitorum crassitatem æquabat. Non longe a basi, ubi latius erat, octo digitorum latitudinem explebat. Ejus forma conica erat, & in obtusum deducta apicem, non parum versus finem curvabatur. In basi tamen, ubi collo nectebatur, arctius erat. Color circa extremitatem subniger lucidusque erat, & persimilis ei, qui in ungula bubula passim observatur. Exterior superficies aspera erat, præcipue

a basi usque ad medium; etenim cuticula & subiectum reticulare corpus cum contentis papillis (quæ in aliis partibus perpendiculariter attolli solent, ac tactus organum constituunt) sensim produci inclinarique incipiebant, non dispari specie, ac in nostrorum digitorum extremitate, quilibet prope unguum radicem observare potest. Papillæ igitur, laciniata cuticula, & reticulari corpore circumdatæ, maiorem longitudinem sortitæ ita inclinabantur, & invicem hærebant, & ferruminabantur extremis finibus, ut squamosum piscium tegumentum æmularentur. Circa basim squamosa hæc corpora brevia erant, sensim vero producebantur & prope conum longissima reddebantur. Varius quoque erat substantiæ modus; nam in basi pupillaria hæc corpora non ita sibi mutuo connexa conglutinebantur; sed solutis ipsorum finibus laciniatum & asperum excitabatur corpus: ultra tamen medietatem densiori donabantur compage, unde & lucida & lævia videbantur. Interius expositum cornu concavum erat, ita ut crassities ipsius in basi nativam corii alitudinem parum excederet; gracilescente autem & attenuato corio ad naturam quasi membranæ intus ambiebatur, quod sanguinea vasa irrigabant; hocque detracto solidum & læve corpus occurrebat. Tota concavitas referta erat subflavo, turbidoque sero, quod igni appositum, totum fere in naturam albuminis ovi crescebat. Sub basi glandulæ conglobatæ, depressæ tamen, insigniter luxuriabant. Hoc itaque famigeratissimi Aldrovandi Museo dono dedi, ut exterorum præcipue curiositati præsto esset. Ex huius igitur diligenti inspectione patet, papillas (quas non incongrue externi tactus organa credidi) cuticula & reticulari corpore custoditas, ubicunque plus justo producantur & invicem intime unitæ ferruminantur, in solidum definire corpus; quod commune est ungulis & cornibus, quæ sola exteriori configuratione, & majori minorive partium densitate donata adinvicem discriminantur; unde veluti

ti sensorii additamentum censenda veniunt, & tactui quoque non parum conducentia. Cornuum e cranio erumpentium observata productio his multum lucis confert. Hanc itaque vegetationem in bove deprehensam in Physicæ additamentum audire ne graveris. In foetu igitur, adhuc in utero contento, cranii os in situ cornuum fere cartilagineum est, & postremo osscam naturam acquirit. Pili ibidem primo erumpunt glabro existente corio præter labia, quæ quibusdam pilis ornantur. Hi taliter locantur, ut ipsorum ordines a circumferentia versus centrum situati & inclinati minimum quasi conum efforment. Postremis quoque mensibus in foetu adhuc concluso ossæ lamellæ (quibus cranium compaginatur) obliquari incipiunt, & fracta directione extra eminent, excitatis intro subrotundis spaciolis, unde supra cranium ossæus tumor primo emergit lenticulare corpus præ se ferens. Hoc extenso corio cooperitur, quod præ reliquis crassum est, & turgentes exhibet glandulas. Inter ossæum corpus & corium periostion, seu ossæ substantiæ inchoamenta locantur, quæ paulatim manifestantur. Extra uterum sensim ossæus tumor lenticularis parum assurgit, turgentibus ossæis lamellis. Supra os crassum luxuriat periostion, seu futuri ossis inchoamentum. Corium quoque obducitur, a quo tactus papillæ assurgentes reticulari & cinereo corpore ambiuntur: hoc copiosis pilis diversam inclinationem sortitis cooperitur. Altero elabente mense, ossæa substantia laminulis & spaciolis contexta extuberat ita, ut cornu rudimentum emergat, dimidiam digiti crassitiem æquans, & conoidem parabolicum repræsentans. Hujus exterior superficies lævis & glabra sensim redditur, nigroque inficitur colore. Corium crassum de more extenditur, a quo tactus pupillæ erumpentes, superato reticulari involucrio, quod cinereum est, elongantur & nigro ambiente succo conglutinantur. Hæ circa cornuum basim inclinatæ versus apicem diriguntur; reliqua vero ab apice exortæ perpendiculares

culares quasi assurgunt, & reticulari corpore custodiuntur: earum longitudo vix ferici villosi lanuginem æquat. Interea inclusa ossea appendix augmentum capit, & interius varie configuratur; etenim ut plurimum radix fistulosa excitatur substantia quæ osseis fibris reticulariter implicitis componitur; reliquum vero usque ad apicem spongioso constat corpore. sanguinea intercurrent vasa, & apex perpetuo submollis firma partium compage non gaudet. Corium quoque extensum osseam substantiam investit, & in basi crassius est. Ab hoc itaque emergentes tactus papillæ ita proceræ redduntur, ut inclinatæ versus apicem, simulque reticulari corpore unitæ tot conica corpora concava efficiant, & ex horum unione (quasi tot lamellis, cæparum instar intra se positæ) solidum cornu corpus efficiatur. Papillarum ordines in basi erumpentes, licet non omnes apicem attingant, ut plurimum tamen recta deducuntur, & fere cornu ambiunt: aliæ quoque sub diversis planis a producto corio propagantur, quæ longiores redditæ, breviores cooperiunt & includunt: unde secto per longum cornu non solum ossea substantia occurrit, sed etiam corium, a quo molles papillæ emanant, quæ in cornuum substantiam immutatæ solidescunt, & nigrescunt; avulsoque osse cum ambiente corio, fistulæ in cornu a reticulari opere excitatæ patent. Occurrunt quoque papillarum tactus varii exortus & plana, ipsarumque productio usque ad apicem; unde cum diversa plana extremum conum constituent, hinc est, quod apicis substantia crassitiem fere digiti æquat. Exarata papillæ basim cornuum excitantes molles adhuc sunt, & de facili lacerantur, vel in furfures abeunt; circa finem vero & apicem ita adensantur, & reticulari corpore ferruminantur, ut solide factæ nigro lucidoque inficiantur colore. Harum progressus evidens est; nam tot quasi filamentis perlongum ductis, coagmentari videntur. Procerioribus redditis cornibus ita, ut duodecim digitorum crassitiem æquent, inclusa appendix

dix ossæ longior redditur, & ubi continuo & pleno ossæ non coagmentatur, variis cellulis concameratur & excavatur. Secto autem cornu per longum, singula dilucidius patent. Primo enim frequenter exarata appendix ossæ laminâ componitur ita, ut tubus efficiatur; portiones tamen ossæ oblique per transversum ductæ interferuntur, unde relictæ aræ concavitates oblongas, inæqualis tamen longitudinis & figuræ efficiunt, in quibus aliæ quoque ab assurgentibus parum ossæ parietibus designantur. Omnes hæ concamerationes membrana tenui obducuntur, sub qua sanguinea vasa in miras propagines diramata custodiuntur. Versus apicem ossæ substantia spongiosa est nullis cellulis excavata, unde impense rubet ex innumeris vasculis, quibus irrigatur. expositam appendicem ossæm extenuatum corium ambit, a quo molles de more tactus papillæ emanant, quæ reticulari corpore custoditæ, simulque ferruminatæ, versus apicem deductæ cornu componunt ita, ut cornuum parietes in basi graciles sensim ex papillarum additione reddantur, & tandem in apice ex omnium unione, duorum digitorum crassitiem æquent. Horum interior superficies nigra est, & fistulosis foraminulis versus apicem directis asperatur, quibus papillæ admittuntur. Exterius apex acuminatus solidus, lucidus & ater est: versus medium tamen subalbescit cornu, & circa basim parum nigrescit, & de facili in squamas solvitur. Ulterius tandem augmentum sortiuntur cornua ita, ut urgente interiori ossæ appendice primi papillarum ordines a basi erumpentes avulsi a corio separentur, & ita diversi fines & papillarum limbi apparent non dispari ritu, ac in conchis marinis conspiciamus, quarum compositio diversis testulis superpositis, inæqualibus tamen, coagmentatur ita, ut extremi fines quarumcumque testularum minimum elegantque exhibeant planum. Hæc eadem structura evidenter quoque in dorcadis cornibus elucescit, unde a radicibus usque ad medium asperitates, quasi nodi observantur,

vantur, quæ a diversis papillarum lamellis vario tempore a corio avulsis, & sursum retractis excoriuntur, quæ omnia diligenti microscopii lustratione patent. Postremo tandem cornua ultimum sortita incrementum non parum immutantur; nam exterius ipsorum color varius efficitur; substantia quoque solidior reddita, diaphana fere evadit, & continuo usu leuigatur. Interius ossea appendix obtuso terminatur fine, totaque ipsius longitudo gracilescente corio adhuc tegitur. Ab hac emergentes olim tactus papillæ obliterantur præterquam in apice; interior enim cornuum superficies evanescentibus vaginulis, seu reticularis corporis finibus ex ferruminantis succi exundante copia, tota fere circa basim lævis & pèrpolita redditur ita, ut papillarum productiones quasi obscurentur. Analogam quoque generationem in gallorum calcaribus observamus, quæ ex cuticula & subjectis papillis reticulari corpore conditis conflantur, ita, ut turgente intus ossea appendice exterius quoque corium multiplicibus cuticulæ involucris obductum rapiatur, & novum quasi cornu, licet minimum, erumpat.

Ex his igitur conjectari licet, monstruosum cornu in bove ortum traxisse non tam ex ulteriori papillarum corii, & reticularis corporis productione, sed ex conatu interioris tumoris, & ex compressione facta in cervice a proximo jugo: in naturale namque cornuum eruptione emergens ossea appendix extensam sibi corii portionem sensim urget, secumque rapit ita, ut papillæ versus apicem inclinatæ elongentur. Proceriores autem redditæ sunt in monstruoso cornu tactus papillæ ex copioso fortasse succo per filamentorum reticularem contexturam, qua corium componitur, excurrente, vel elabente in continuatas papillas & in mucosum; reticulareque corpus, ut in unguarum vegetatione contingit, quæ cum extremis papillarum finibus excitentur, in deformem producerentur longitudinem, nisi vel arte, vel attritu mutilarentur. Probabile quoque est ex urgente assidue
jugo

jugo proximam cervicis partem compressam & inde callosam redditam fuisse. sanguinis namque motus non ita foeliciter celebratus est; ichoris quoque & lenti humoris per exaratam corii contexturam ulterior fluxus impeditus est, & sudoris, halitusque effluvia per propria sudoris vascula suppressa sunt, unde corii papillæ ultra augmentum in novum situm & compagem adaptatæ sunt, & reticulare corpus, quod alias mucosum est, pene osseam nactum est consistentiam. Hæc autem ferruminatio probabiliter contigit ex vitriolato humore per excretoria sudoris vasa effluente, vel saltem ab acidis effluviis coercitis & fixatis, dum interim evaporantibus alcalibus & aquosis particulis sanguinei instar feri solidum, lucidumque fere corpus excitatum est.

Aliud quoque monstruosum in Illustrissimi Juvenis *Antonii Francisci Daviæ*, excelsi Antianorum Consulis, cadavere observatum non parum exaratam a me renum structuram illustrat. Hujus itaque *Ren* sinister, exiguus mole exterius quasi congeriem & racemum unæ albæ exhibebat, multiplicibus scilicet glandulosis folliculis, veluti tot exiguis botris congestus: Hi insignibus excretoriis vasis, quibus de more renum caro excitatur, haud donabantur; sed immediate expanso pelvi, vel saltem brevissimo ductu neceiebantur. Venæ & arteriæ singula irrigabant, & ureter e pelvi producebatur. Ren dexter mole longe major erat, & exterius insignes glandulæ quasi vesiculæ urina turgidæ erumpebant. Congeries quoque excretoriorum vasorum, quibus renum caro conflatur, amplior & latior solito erat, & appensæ glandulæ amplæ quasi vesiculæ interferebantur. Harum aliquæ corrupto & subnigricante sanguine scatebant; reliquæ urina turgebant, vel arenulis, tartareaque materia referebantur. Ex hac itaque renum, licet monstruosa, sed simplici structura, evidenter patet, præcipuas renum partes, præter arterias & venas, glandulas esse, & pelvim, qui in ureteres productus in glandulis lotium per excretoria

vasa recipit, & sensim in vesicam derivat. Turgebant autem glandulæ, & monstrosa deformabantur specie, quia impedita excrementi expulsionem in pelvim, necessario stagnante intus urina, laxabatur glandulosa compages, & in aliquibus etiam loco feri rubicunda sanguinis portio continebatur; impedito scilicet per venas regressu, vel lacerato separationis organo. Hoc idem in reliquis glandulis accidit vi morbi, & præcipue in jecore, in quo vigente cachexia non raro ipsius glandulosi acini turgente bile, quandoque sero, aut tartaro, in amplio-rem ita extenduntur formam, ut vesiculas emulentur. Simplicissima quoque glandularum structura in pluribus partibus observata totum confirmat, nam in labiis bo-
 vum, in hominis facie, circa penis glandem, in intestinis, & in muscutorum spaciis minimæ, simplicesque locantur glandulæ, quæ nil aliud sunt, quam rotundi, interdum ova-les, & non raro oblongi folliculi excretorio vasi continuati, & appensi, quorum varia structura diversi separantur humores, & succi.

A Letter from Mr. Charles Leigh of Brazen-Nose College in Oxford. to Dr. Rob. Plot Director of Experiments to the Philosophical Society of Oxford, and one of the Secretaries of the Royal Society.

SIR,

Since you gave me some specimens of the water of *Latron*, and likewise of *Nitrian Nitre*, I have found that those Descriptions which the Antients give of it, exactly agree with those specimens we have here; their encomiums of it were so many, but so different the names which they ascribed to it, as a sceptic indeed might equally question whether or no they writ of any thing else, or whether or no they writ of any such thing. That we might therefore the better understand the writings of the Antients concerning it, and the *Phænomena* which it afforded here, I have thought convenient to make use of this method. I shall in the first place shew whence *Nitre* has its denomination. In the second, the different names which ancient Authors ascribe to it. In the third, the different places whence it comes. In the fourth, a description of it as it is when a *Compositum*. In the fifth, the number of its principles when chymically resolved. In the sixth, the rise of them. In the seventh, its separation from the water of *Latron*. in the eighth, its use in *Physick*. In the ninth, in *Agriculture* and *Mechanicks*. In the tenth, wherein it differs from *Sal Armoniac*. In the eleventh, from *Salt-Petre*.

That all *Nitre* took its name from a Town in *Ægypt* called *Nitria*, I shall take for granted: I shall therefore in the next place give you an account of the different names, which by Authors are ascrib'd to *Nitre*.

By Hippocrates ^a it is sometimes called *Sal Ægypti*, *Sal in aquis crescens*, and *Nitrum Rubrum*. By Basil. *Serpens Terrenus*. By Vitruvius, *favilla salis*.

By Pliny ^b *Spuma Nitri*, and *Ros pinguioris Naturæ*, by the Græcians *Halmiraga*.

By Encelius ^c it is called *Cryso-Colla*, *Baurac*, *Sal lucidum*, *Sal petrosum*, *Sal Anderenæ*. But the word *Baurac* by the Babylonians is more restrain'd, for they divide *Nitre* into two species, the one they term *Sal petrosum*, *pureum*, *Modice amarum*; the other species they term *Baurac*, which they used in seasoning their meat, the former of these may probably be the *Nitre* here spoke of, and the latter *Salt-Petre*.

By Jungius ^d and Hofman it is called *Cerberus Chymicus* and *Sal infernalis*. By Rulandus ^e and Johnson it is called *Fex vitri*, and *Cinis Clavellatus*, and so by Fallopius, and sometimes *Cabalatar*, *Algali*, *Anatron*, *Tincar*, *Sago*.

Here likewise it is to be noted, that *Aphronitrum* call'd by Schwenckfeldius in his Tracts *de Fossilibus Silesiæ* (*flos Asiæ* and *Spuma Nitri*) is not (as I conceive) specifically distinct from the *Natron* here spoke of.

For according to Molenbrochius ^f and Junken ^g that will ferment with an Acid, and is commended in the same distempers, as the *Nitre* of *Nitria*, again it's said by Pliny, *fontibus quibusdam innatat, videturque Nilo deferri*.

By Encelius it's said to be found either in *Armenia*, *Rabbath*, *Africa*, *Rome*, *Ægypt* or *Babylon*, and therefore by him is divided into these six species. *Nitrum vel est Armen. Afric. Ægypt. Rabbath. Rom. vel Babyl.* By Wormius it is said to be found in *nova Hispania*.

The *Natron* may be described thus; it is an Alkaly Salt perforated like a sponge, and of a lixivial tast; and

(a) *de natura & morbis mulierum*. (b) *naturali historia de nitro*. (c) *de re metallica*. (d) *physic*. (e) *Lexicon. Alchymicæ*. (f) *de Arthritide*. (g) *Medicus*.

thus

thus I find it describ'd by a *Pliny*, a *Mathiolus* b and *Agri-*
cola. c

Its principles I take to be chiefly two, viz. a *Sal ma-*
rine, and an *urinous Salt*.

That it contains a *Sal marine* seems manifest by these experiments; first because a solution of the *Natron* has the same tast that a solution of *Sal marine* hath; secondly in evaporation the particles of the *Natron* incrustated upon the surface of the water as the particles of Sea-Salt do in evaporation. Thirdly because the *Natron* is perforated, which proceeds (as I suppose) from a *Sal marine*, for that when it crystallizeth, shoots with little cavities. Fourthly if the *Natron* be mixt with Salt of Tartar it emits the same spirit, as *Sal Armoniac* when mixt with the same Salt And lastly, that it contains a Sea-Salt seems plain from *Cesalpinus*. says he, *efflorescit etiam sponte non solum in salinis ad similitudinem lanuginis canescentis, sed etiam in vasis in quibus sal continetur.*

But here it is to be noted that though the *Nitrian Water* is of a blusky colour, and makes a brisk fermentation with an Acid; yet a solution of *Natron* looks clear and will not ferment with an Acid. The reason why a solution of the *Natron* looks clear, though the *Nitrian Water* which is but a solution of the same salt is of a blusky colour, may perhaps be this;

I suppose that the water of *Latron* receives its redness from a red clammy substance, which serves chiefly to cement the two salts together, and this I the rather conjecture because after a solution of the *Natron* had past through a filtre there stuck to it a red clammy matter, and the solution was clear; and the reason why a solution of the *Natron* will not ferment with an Acid, I conceive to be this; because that in a perfect dissolution its parts being separated one from another by the parts of the water, their struglings are too weak to make an effer-

(a) *nat. hist.* (b) *comment. in Dioscor.* (c) *cap. de nitro.*

vescency

vescency with an Acid, and in this I was further confirm'd by these two experiments.

I found that if into a solution of the *Natron* I pour'd an Acid, while the water look'd whitish or disturb'd the Salt not being perfectly dissolved it made a brisk fermentation: but when the water came to be clear, the Salt then being perfectly dissolved, if I then poured an Acid upon it, it would not ferment: I likewise found that this solution being evaporated to a third part would ferment again.

It's second principle I take to be an *urinous Salt*, first because if mixt with salt of *Tartar* it smells like *Sal Armoniac* when mixt with the same Salt.

Secondly, when it was distill'd with salt of *Tartar* in a Retort, it afforded an *urinous spirit* as piercing as the spirit of *Sal Armoniac*.

I come now to the rise of its principles *Sal Marine* and a *Volatil Alkaly*; *Sal Marine* being a fossil Salt I shall take for granted it receives from the earth and shall endeavour to illustrate that it hath its Volatile Alkaly from the air, first because its said by *Pliny*, *Spumam Nitri* (which is the *Natron* here spoke of) *Antiqui negabant fieri nisi cum ros cecidisset*. By Mounseur de la Chambre, it is affirmed that three or four days before the Nile begins to overflow, there falls a certain dew which hath a fermenting vertue, and leavens a past expos'd to the air, and at that time saith *Pliny*, and Mounseur de la Chambre the Nitre Pits grow full of Nitre. And *Sands*, *Vanflebius* and several say, that tho 500 in a day die in *Grand Cairo* of the Plague before the beginning of the inundation of *Nile*, yet the very day after, there does not one die, which doubtless could not proceed from any other reason, then because at that time, the air was impregnated with this Volatile Alkaly, for at that time the Nitre Pits grow full and this dew falls; (this I think) may sufficiently hint to us the great use of its volatile spirit especially in pestilential distempers.

Lastly, about that time that the *Nile* begins to o're flow those

those specimens which we had here grew heavier by being exposed to the Air.

Here it is to be noted that this *Alkaly* is not made so by fire : I cannot therefore conclude with *Helmont* that all Alkalies are made such by that element.

The next thing to be considered is its separation from the water in *Latron*, of which the Learned Dr. *Huntington*, (who was at *Nitria*) gives us this account.

There is a town in *Egypt* called *Nitria* which gives name to the *Nitrian Desert*, where there is a lake called *Latron*, taking up an Area of six or seven acres situate about 30 miles West and by South from *Terana*, a Town lower upon the *Nile* than *Grand Cairo*, and about the same distance North-west from the *Pyramids*, from the bottom of this Lake this sort of Nitre called *Natron* riseth to the top (as they do apprehend) and there by the heat of the Sun condenses into this kind of substance. That all the Nitre comes from the bottom to the top I dare not affirm, & shall therefore premise some *Phænomena* which it afforded in evaporation, before I give you my conjecture about it.

I took an evaporating glass which held about 4 ounces, and poured into it 2 ounces of the *Nitrian Water*, this I set upon a sand furnace, giving it fire by degrees, as soon as the water was warm the particles of the *Nitre* began to swim upon its surface in stragling and uneven numbers, these after a while united, and at last there arose Salt sufficient to cover the whole superficies of the water, I took then a thin glass and skim'd off this Ice, but could scarce take it all off before it was seconded by another, and thus the salt did rise successively in films as long as there was any water in the glass, these films had the colour and taste of the Nitre which came from *Nitria*, and did like it ferment with an Acid. And these are they which by *Pliny* are called *Flos salis*, and if I mistake not the same with that which *Herodotus* says they make their Mummy with. If therefore by the languishing heat of a digesting furnace, the nitrous particles could separate themselves from the
water,

water, and over that spread themselves in an ice, it may be as probable, that by the greater heat of the Sun, the Nitre of *Natron* is separated from the water after the same manner: And as in the evaporation of other mineral waters, when the water is not strong enough to hold up the Salt, it is generally covered with a thin film; so I suppose in evaporation of the *Natron*, some parts of the water being flown away, the particles of the *Sal Marine* branch one into another, and so incrustate upon the surface of the water.

In this *Hypothesis* I was the further confirm'd, by this Experiment, I took some of the *Natron* and dissolved it in water, and set it to evaporate, and I found that the Salt did not incrustate upon the water till 3 parts of the water was evaporated, it did not therefore seem probable that the Nitre came all from the bottom to the top, and so condensed by the heat of the Sun, but that they incrustated when the saline particles brancht one into another, some of the aqueous parts being exhal'd.

The reason why its volatile Alkaly in evaporation does not fly quite away, is because it is held there by the *Sal Marine*.

The next thing to be considered is its use in Physick: By *Pliny* it's commended in Ulcers, Inflammations, Palsey in the tongue, Consumptions, Collick, Hemorrhages, Purulent ears, and intermitting Fevers. By *Gallen* it's said, *desiccet, ac digerit, multo autem majus ejus spuma*.

By *Agricola* it's prescribed in the same cases, commended as a Cephalic. Of wonderful success in the griping of the Guts, intermitting Fevers and the Leprosie. *Mathioli* commends it in the same cases.

By *Hippocrates* it is commended when the *Menstrua* are obstructed, and again (saith he) *purgat humores albos, convenit in abortionibus ubi puer haud exierit*, he likewise commends it in some kind of barrenness, and to this *Kir-*

cher

cher in his *Mundus subterraneus* alludes, when he says, *Nili aqua in potum redit non modo saluberrimum, sed & fecundandis mulieribus mire opportunum*, and *Petrus Giurius* a, gives us this memorable story out of *Cæsius*, that when *Philadelphus* King of *Ægypt* married his Daughter *Berenice*, to *Antiochus* King of the *Assyrians*, he commanded her to drink of the water of *Nile*, that she might make her Husband happy in a numerous offspring.

By the Testimony therefore of *Hippocrates* b, *Gallen* c, *Mathiolus* d, *Dioscorides*, *Pliny* e, and *Agricola* f, it appears to have been of great use in Physick.

But here it is to be noted, that when Nitre by the afore mentioned Authors is prescrib'd, that Nitre which is an ingredient of Gun-powder, is not to be understood.

Amongst the Moderns we have this account of it, *Monfieur du Clos* is of the Opinion that most of the mineral Waters in *France* are impregnated with this sort of Nitre, and that all their Cures are done by it g.

Molenbrochius affirms a tincture of *Aphronitrum* to be of wonderful efficacy in the Stone h : this I the rather credit, because it's said by *Juncken* in his *Medicus*, the Nitre of *Nitria* is of so piercing a spirit, that it doth not permit either Stone or Rock to be there about. And *Ten Rine* in his *Meditations de veteri medicina* affirms it to be of wonderful success in the same distempers.

The next thing to be considered is its use in Agriculture, and in treating of this, I think it convenient to

(a) *Arcanum cidularum*. (b) *de natura & morbis mulierum*.
(c) *de nitro*. (d) *comment. in dios.* (e) *nat hist.* (f) *de fossil.*
(g) *mineral waters of France*. (h) *de Arthrit.*

premise one *Phænomenon* which it afforded in evaporation. When the Salts had spread themselves over the water in an Ice, those thin plates after a while would break, and ascend in perpendicular lines to the very top of the glass, I do therefore conjecture, that *Nitre* may be said to fertilize the ground after this manner, its volatile particles being heated by some subterraneous fire, or else by the warmth of the Sun, they do quickly ascend in the small tubes of the Plant, and so by their elastick nature carry along with them or force before them, those particles which as they differently convene together, constitute the different parts of the Plant.

But this conjecture will be made something the more probable, by an Experiment in *Kircher* a; where he says if you take a wooden tube, and put into it Tartar, quick-Lime, Salt, and the Urine of a Wine drinker, reduced into one mass, which is to be hardened in the Sun; and after that set it in a cold Cellar, by the help of *Salt-Petre* from the before mentioned Mass, you will not without admiration see Flowers branch out of it; yea such is the force of *Nitre*, that if in a Glass kept close shut, you put the juices of some nitrous Herbs on the before mention'd Mass, the *Nitre* contain'd within it being pregnant with Spirit, will force it self through the very pores of the Glass.

Mr. *de la Cambre* says, Plants do grow in *Ægypt* in such abundance, that they would choak one another, if they were not hindered by throwing sand upon the fields, insomuch that the *Ægyptians* must take as much

(b) *Mund. sub. cap. de nitro.*

pains

pains to lessen the fatness of their Land, as other Nations do to encrease the fatness of it.

In Mechanics we have this account of it: It's said by *Pliny cap. de Vitri Inventione*, that a company of Merchants being thrown upon a shore where there were not any stones to be found, were forced to take great pieces of Egyptian *Nitre* out of their ships, and make walls, upon which they hung their boyling Kettle, the *Nitre* being heated by the fire, mixt with the sand, and ran into several streams of glass, which afterwards hinted the way of making Glass. It is likewise of use in Dying, for *Pliny* and *Vitruvius* affirm, that by the help of this, the true Azure is made, and that without this, there cannot be a true shadow.

In the last place I come to consider wherein it differs from Salt Petre, and Sal Armoniac, it may be distinguished from Salt Petre first by its fermenting: it will ferment with any Acid, but Salt Petre will not: I found that it would ferment with Vinegar as the old Commentators observe in their Comments upon *Jeremiah* and the *Proverbs*, but Salt Petre will not: which gave occasion to some, in those Texts, to alter the word *Nitre*.

Secondly, it may be distinguished from Salt Petre in its taste, for *Natron* hath a lixivial taste, but the other not.

Thirdly, by the volatile Spirit which it affords: for from the one comes over a volatile *Alkaly*, but from the other a corrosive Acid.

Fourthly, the *Natron* affords a red clammy substance, insipid, but the other not; this clammy substance (if

(a) *de Architectura. Lib. 7.*

I mistake not) is that which by *Pliny* is called *ærugo Salis*, this it hath from the earth, and therefore it is again said by *Pliny*, *sunt ibi nitrariæ in quibus et rufum exit a colore terræ.*

Fifthly, like *Salt Petre* it will not Chryftallize.

Sixthly, in the fire it makes no detonation. But in this it resembles *Salt Petre*, as that by the flowers of Sulphur is made into a *Sal Prunellæ*, so this if you drop Spirit of Sulphur upon it, shoots into Pyramidal Salt, that is not by the taste distinguishable from *Sal Prunellæ*, though its taste before was lixivial.

From *Sal Armoniac* it may be distinguished first by its colour, for the *Natron* is reddish, the other not. Secondly, by the texture of its parts, in *Sal Armoniac* the parts seem close and firmly knit together, but the *Natron* is spongy and perforated. Thirdly, if mixt with *Sal Armoniac*, *Sal Armoniac* emits the same Spirit as it doth when mixt with quick lime.

But I think it comes much nearer to the nature of *Sal Armoniac*, than *Salt Petre*; first, because it is composed of a Sea-salt, and an urinous Alkaly; secondly, like *Sal Armoniac*, when dissolv'd in water, it makes it extremely cold: And as *Franciscus Hernandez* says in his History of *Mexico*, it produces the same effect when dissolv'd in Wine; but I have not at present the convenience of trying this, the *Specimens* now being but small.

I can-
not see the other persons (in
the photograph) who are in the
background of the photograph.

I cannot therefore conclude with *Kircher* a, that the *Natron* is not specifically distinct from Salt Petre; or with *Libavius* that it is a composition of Alum, Sea-salt, and white-Wine. And these are all the Observations which I have been able to make at present concerning this Mineral, if any more occur, you shall have an account of them, from

Your humble Servant.

C. L.

(a) *Mund. subterr. l. 6. sect. secunda, cap. prim.*

Tuta, ac efficax Luis Venereæ, sæpe absque Mercurio, ac semper sine Salivatione mercuriali, Curandæ methodus. Authore Davide Abercromby, M. D. Lond, in Octav. 1684.

THe Author describes the nature of the French Pox, which he asserts to consist in a *cold moist Vapour*, lodg'd chiefly in the Organs of Generation, and thence diffused throughout the whole Body: which assertion he endeavours to make good by several Arguments.

He explains the manner, how it first invades, and the several steps of its progress.

He enquires into the nature of Mercury, examines *Untzer's* Description of it, which he confutes as to some particulars. and at last affirms, that, Mercury is of a *moist and cold nature*. From the premises he concludes, that Mercury is not proper in this distemper.

He proposes a way of curing the Pox, without the use of Mercury.

A second way of curing the Pox, in which Mercury is used, but not in order to Salivation.

He

He puts down several topical Remedies; answering some of the severer Symptoms of the *Lues*.

He describes the Symptoms of it, at its first appearance.

He shews how far the Scurvy and French Pox agree, as to their Symptoms.

He gives the method of curing *Virulent Gonorrhea's*, and *Venereal Bubo's*.

He relates some approv'd *Topical* Remedies against the more considerable symptoms attending a *Virulent Gonorrhea*.

He reckons up the difference between a simple and a *Virulent Gonorrhea*.

And at last, he considers how well his Remedies are adapted to his *Hypothesis*, of this Disease.

O X F O R D,

Printed at the THEATER, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON, 1684.

PAge 536. l. penult: read arrival. p. 552. l. 1. read 24 days. p. 555. l. 8. v. Hippocrene. p. 566. line 28. after fountain add (as in Fig. 2.) p. 569. l. 3. for G and D read Cand D. p. 576. l. 8. for 95. read 95. p. 578. l. 7. read penultimate.



Philosoph. Transact. Number, 161.

Fig. 1.

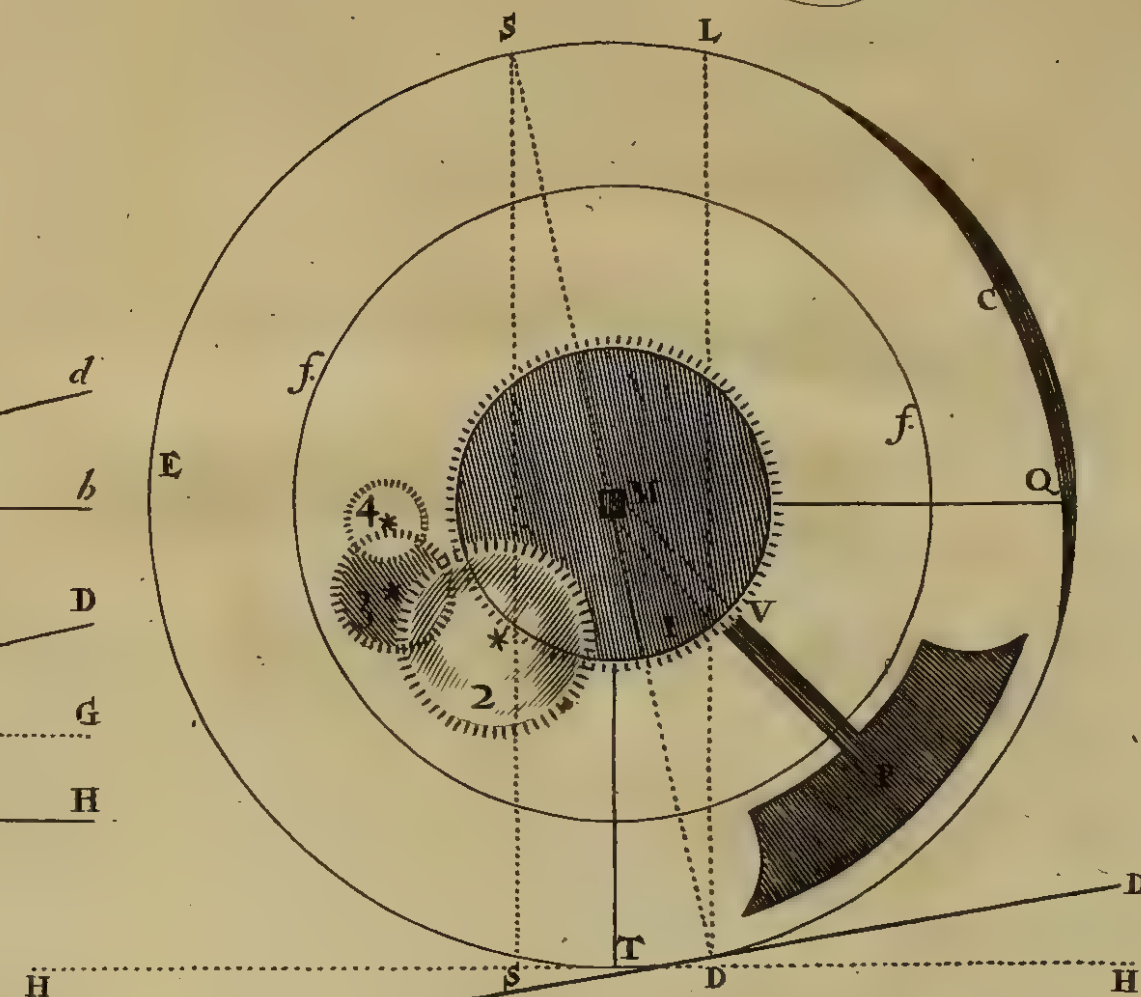


Fig. 2.

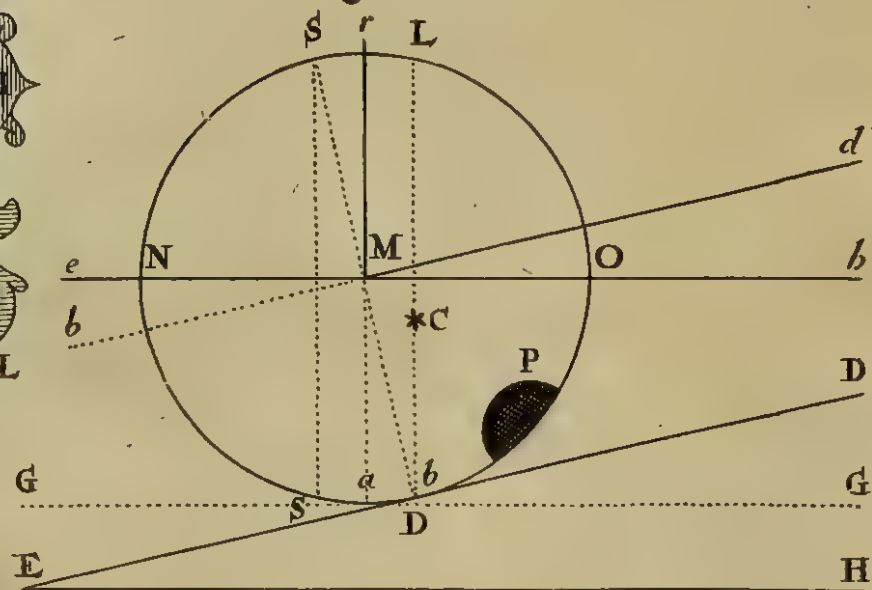


Fig. 4.

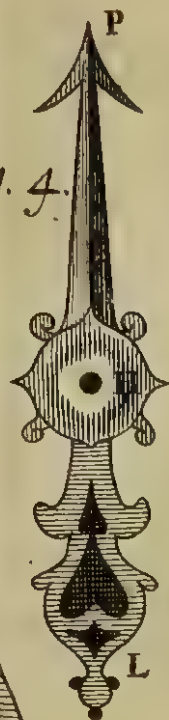


Fig. 3.

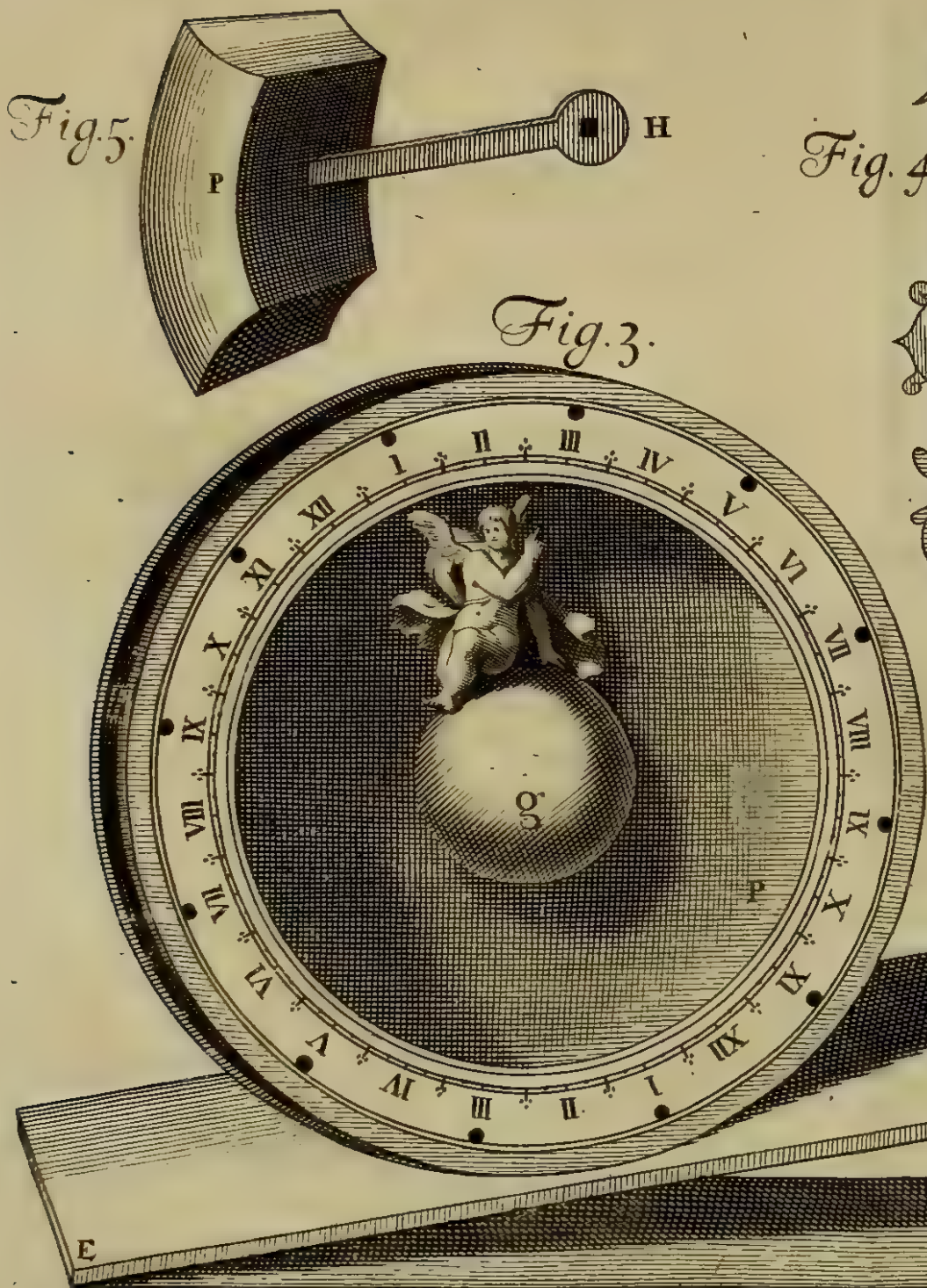
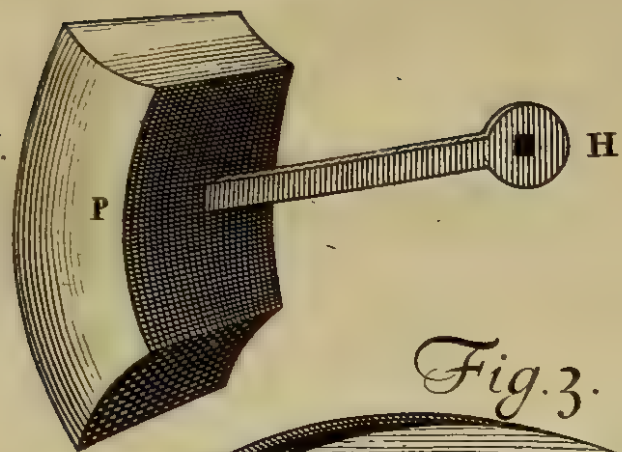


Fig. 5.



MBurghers sculp.

PHILOSOPHICAL

TRANSACTIONS.

July 20 1684.

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F

A Let-

A Letter from Dublin to the Publisher of these Tracts, concerning the Porphyry Pillars in Egypt.

SIR,

YOU engage me after a very undeniable manner, as I perceive by the minutes of your Philosophical Society, to send you some Account of the *Porphyry Pillars in Egypt*: And though I could have satisfied your Curiosity much better in this matter, had you thought of it when I was amongst my Papers in *Oxford*; yet rather than hazard your good Opinion, or give the least pretence of disrespect to your worthy Company, for whose persons and designs I have so just an esteem and veneration: I here send, not what's fit for me to write, or you to read; but what I can remember upon this subject.

Nor do I intend to speak concerning the nature or composition of stones in general, or of *Porphyry* more particularly: But meerly as to matter of Fact, so far chiefly as it fell under my own Cognisance, *i. e.* if you please, rather like an *Historian* than a *Philosopher*.

In the first place then, I think it may be taken for granted, that there is no such *Quarry*, or Rock of stone rather, in all the lower parts of *Egypt*: For so far as the Nile o'reflows, is perfect soil. A sample whereof I hope you still retain; and let me entreat you to be very exact in weighing it this year, that you may be sure whether it be heavier in the time of the Inundation (as is generally believ'd) than before or after: And when, and in what proportion, it encreases.

The Boundaries of this overflow (which are never 10 miles from the *Channel*, that I saw, generally scarce $\frac{1}{2}$ of it, and in some places but a mile or two, (the *Delta* still excepted which is universally covered, all but the North side to the Sea, and a little to the East for some miles above

bove *Damiata*) are rising hills of sand, beyond which is perfect desert, upon the *Afric* side, the *Libyan*. [Higher South I have been told, there are Rocks nearer the River, and in some places streighten it] but under those sands, is a yielding stone, not much harder than Chalk, tho not so white, and very easily manag'd, as at the *Mummies*, deep spacious Vaults which were the old Repositories for the Dead. And the like also may be said of those Cells or Sepulchres which are hewn purely out of the rocky earth $\frac{3}{4}$ mile on the South of *Alexandria*. Albeit nearer the Sea, there are stones of a harder kind, and with which they build: but by their mouldring away, as appears by the Remains of houses within the Walls of the City, 'tis plain they can't endure the weather; which is sufficiently corroding there: The Iron which once plated their thick wooden Gates being mostly eaten away, and the deep Characters upon the sides of these very *Porphyry Pillars*, exceedingly defaced. Indeed about *Memphis* i. e. by the *Pyramids*. they have a milder Air; and the *Hieroglyphics* cut in those stones will last well enough, till they shall be removed into a rougher: But then, they'll crizle and scale, as I found by sad Experience. For having procur'd 4 stones, the best mark'd with those figures of Antiquity, I could meet with, and sent them down to *Alexandria* in order to their Transportation for *England*; I found them upon my second Voyage into *Egypt* very much injur'd, being put into the Custom-house-yard (where they lye still embargo'd,) by the *Agas*; who demanded an intollerable Summ for liberty to ship them, as you may remember I told you the story.

But yet farther in the Country there are Mountains of harder stone: In the *Nitrian*, now the Desert of *St. Marcarius*, and not far from the Lake where the *Latroon* or true *Nitre* incrustates upon the top of the water, there are many; and some of them not utterly unlike *Porphyry*. That which nearest resembles its Colour, tho not

its Consistence, is the vein that produces the Eagle-stone: of which there are many in the *Bahr Batama*, a great sandy valley. But these stones are of a different Complexion from *Porphry*, as you may perceive by those I sent you, which also will assist your Conjectures of their original.

However, I can't pronounce that there is no *Porphry* hereabouts: For in the chief Monastery of the 4 now remaining (of 366 as many as are days in the longest year) dedicated to the *Blessed-Virgin*; the 2 stones which secure their Entrance are of the like, if not the very same substance: which I more particularly observ'd upon the account of their ingenious Contrivance. For these poor people, lying otherwise at the mercy of the roving *Arabs*, with these 2 Mill-stones (for that's their make) thus make good their Gate against them, (or rather their passage;) into which they run them, and then drive a great wooden wedge between them on the inside, which so fastens them that they cannot be loos'd but upon the inside neither. And of such a sort of *Porphry*, is the noted *Sphynx* (a mighty head and shoulders 110 feet in compass) yet standing by the Northern *Pyramids*.

I have indeed been told of the place upon mount *Sinai*, whence this *Porphry* came: but so they shew the very Rock where the 2 excellent double Rows of Pillars, in the Church of *Bethlehem* were hewn: tho' I went away satisfied that 'twas a quite different sort of stone. Another tells of a Pillar of the same make yet lying there: and if this be certain, you need seek no further. Albeit, I must tell you that the stones brought thence, with the Representation of a Buck (it must needs be call'd) upon them; some of which you had, tho' reddish; are of a much finer, and more even texture.

Wansleben writes of a great many, more Southerly; but I know him too well to believe all that he says for Gospel. And a more sober man, Father *Carlo Francisco d' Orleans*, now Superior of the *Capucines* at *Cairo*, who went

went 300 Leagues up the Nile in the year 69; told me of many Temples, Statues, and Pillars at that distance; tho I can't be sure he said there were any of *Porphyry*. But since 'twas in *Thebais*, why may we not suppose them of that black, white and red speckl'd *Thebaic* Marble, famous in the World; and wherewith the lesser Pyramid perhaps was crusted, yet to be seen upon the ground about it, and when polish'd looks finely.

Those which I have my self seen, are one of them at the *Matarea*, 3 or 4 miles East of *Grand Cairo*, and 2 at *Alexandria* just within the Wall upon the North side of the City: (for *Pompey's* Pillar as they call it) $\frac{1}{2}$ mile without the Gate to the South, is quite of another make and matter: one of these is thrown down and broken into pieces, but was of the same dimensions for breadth and thickness with the other. The *Francks* call them *Aguglia's*, the English particularly *Cleopatra's* needles; but the Inhabitants content themselves with the general name of Pillars. They have no *Basis* or Pedestals above ground; and if they never had, they must needs be very deep in the Earth. The Draughts I here send you will excuse all farther Description. One of them was very well taken by Monsieur *Brute* a *French Druggerman*; the other by a *Dutch Painter*, who, you'll see, has but little commended his Art.

If you have a Fancy upon the sight of 'em, to sift out the *Hieroglyphic* Character with which they are engraven; perhaps you'll find it to be the Aboriginal *Egyptian* Letter, long since worn out of common use in the Country, as the *Samaritan* (so 'tis now generally call'd,) was amongst the *Jews*. And that it bears proportion with the *China* (now in use) where each note represents a word, or rather an entire signification. And moreover that 'tis wrought the same way too, from the top to the bottom; as you have seen in the Bord I brought from a door in the Village *Succara* (which is next to the *Mummies*) the largest piece

piece of *Ægyptian Writing* perhaps, at this day in *Europe*. I confess that in the Vaults or Priest's Chambers cut out of the Rock, close by the 2^d. Pyramid, the whole walls are inscrib'd therewith; but I speak of an Original. And if all that is there written were but exactly copyed, it might be then lawful to hope, that the Language so long since dead and buried in the House of Bondage, might have its resurrection in the Land of Liberty.

That such vast Monuments might be remov'd from place to place, is difficult indeed, but not impossible. And if one *Archimedes* (as *Athenæus* preserves the story for us) could lanch the vast ship of *Hiero*, which all the strength of *Syracuse* was not able to bring to Sea; what might not many great Masters in the same Art perform, and upon their own Dunghil too? for I may call *Ægypt* the Mother of the Mathematics.

Besides, some of these Mountains are near the *Red-Sea*; and *Suss* from *Cairo* but 2 or 3 days, from Nile less: And how possible it is to convey mighty weights by water, let the Obelisks at *Rome* declare; which were all of them brought from this very Country, And that such things may be done by Land too, tho not by every one; is plain enough, because we see they have been done. At *Baalbec* which is 14 hours from *Damascus* (for thence I went, accompanied with Mr. *Ant. Balam* and Mr. *Jo. Verney*, both now in *England*, whom I thought fit to name for my Compurgators, if you should question the credit of story :) There is a stone about 66 foot long on the N. side of the Castle-wall, and 2 more of 60 each: And I believe we saw the way they travel'd, having left one of their Company, tho not quite so big in the Road, as a Monument thereof to this very day.

If you have got the piece of this *Aguglia* (for I have nothing here;) you will thereby best discern its Colour and Composition: 'Tis something more lively than the *Porphyry* of *St. John's Font* (for by that name 'tis known)

at

at *Ephesus*; much more vivid than those 4 tall square Pillars at *Tadmora* (in its middle age *Palmyra*) which are each of them but of, I think, one piece; whilst all the rest, exceeding many, of another sort of stone, are of several pieces and round: If you'll attribute the clearness of their Complexion, in part to the Air, which corrodes them especially upon the N. and East; I impose not upon the liberty of your Reason.

If the *Ichnography* of them (which I desire you to reserve for me) won't excuse me from any farther description, I beg your pardon that I have said thus much, and hazarded my judgment to demonstrate my Affection, how much I am, and endeavour to be,

Your faithful Friend

And humble Servant,

R. H.

ADVERTISEMENT.

The Cuts of these Pillars are not prefixed to this Paper, because said to be engraven and published elsewhere.

Præ-

Præclarissimo & Eruditissimo Viro D. Jacobo Spornio Medicinæ Doctori, & Lugdunensi Anatomico Accuratissimo. Marcellus Malpighius S. P.

DImissis languentis Naturæ erroribus, plasticæ virtutis officinam contemplemur exarando ea, quæ favente mihi Præclarissimo & Amicissimo D. *Silvestro Bonfiliolo* circa uterum olim moliebar. In hoc itaque obscurissimo omnium viscere extra graviditatis tempus ob contracta vasa, & in varices contorta, ita implicitæ sunt componentēs particulæ, ut nulla fere arte distingui possint. In turgente autem & prægnante utero (brutorum præcipue) quædam emergere videntur. Nonnulla igitur, quæ menti meæ illuxere, dubitative tibi indicabo (non enim integre omnia adhuc sensus meos explent) ut excitata tua sedulitate vel apertius pateant, vel meam phantasiam amplius non imudent. Vaccinum itaque uterum sum aggressus, cujus copia facilius occurrit, & ex magnitudine, minus obscura sunt ipsius componentia. Hujus exterior membrana densa valde sese offert, quæ universum uterum, tubas, vaginam, & appendices investit & firmat. Sub hac, carneæ fibræ locantur, quæ per longum ductæ, & quasi in carneos lacertos interdum adensatæ, diversas inclinationes sortiuntur. Interferuntur autem ad invicem, præcipue versus tubas, & non longe ab ovariis in fasciculos conglobantur. Aliæ quoque horizontaliter secundum crassitiem uteri propagantur, hærentque pelliculis tenuibus sub diversis planis totum uterum ambientibus. Non longe ab his occurrunt lymphatica vasa proprio turgentia humore, qui admoto igne tandem perspirat. Sub prædictis vasis venæ & arteriæ excurrunt hinc inde uterum ingressæ, ita, ut rete elegans efforment, cujus areæ diversam exhibent figuram.

Solent

Solent tamen, ut non raro observavi, gemini venarum rami unicam concomitari arteriam. Nervi quoque interferuntur totam uteri molem pervadentes.

Alia quoque vasa, seu ductus, quæ uteri propria sunt, insignia & perampla graviditatis præcipue tempore deprehendi. Horum itaque varia est productio, cum ab uteri substantia partim emergant, partim quoque interius lateant, unde circa ipsorum progressum non parum laboravi, qui, prævia tamen hac nostra exercitatione de facili tibi, aliisque occurret. Hæc gemina sunt, unum enim hinc inde uteri & vaginæ quasi latera excurrit, ea præcipue in parte, qua uterus vesicam respicit & contingit. Et licet ab extrema vagina usque ad gracilescentia uteri cornua propagentur, non eandem tamen ubique redolent speciem, nec consimili magnitudine donantur, aut sub eodem plano feruntur. Inferior namque portio non longe ab urethræ orificio terminata immediate sub membrana interiora vaginæ custodiente sursum recta fertur versus uteri os. Hæc portio frequenter vix stylum admittit, interdum auricularis digiti latitudinem æquat, unde lato capitulo, evidentique hiatu fere semper supra urethræ, seu urinarii meatus orificium in vaginam aperitur. Non longe a plicis, os uteri excitantibus, obliterari videntur hujusmodi ductus, solique (prout visus sum attingere) minimi occurrunt poruli & meatus in continuatum vas desinentes. Hæc itaque obscurior horum vasorum portio ab evidenti ductu exorta intra carneas fibras condita sursum per angustati uteri latera propagatur, donec exterius a cervice erumpens supra uterum producta emergat. Varias sortitur species hæc vasorum portio & acuratam exigit indaginem, ut evidenter patula reddatur; sæpe enim interius condita ita gracilescent hæc vasa, ut quasi in conspicua reddantur: non raro globuli insignes & frequentes attolluntur precariam coronam æmulantes, & interdum turgente intus humore rectus vasorum progressus occurrit. Emergens vero horum ductuum

portio ab uteri cervice supra carneas fibras, & sub sanguineis vasculis lateraliter producitur per corpus & cornua uteri, quorum interiorum circumvolutionem productis hinc inde ramis irrigat, donec obscuris finibus in gracilescentibus tubis oblitteretur. Vasa hæc, licet tubulosa sint & continuato ferantur tramite, ab ambiente tamen involucro, seu ligamento & ab interiori ipsorum structura varie deturbantur ita, ut multiplices formas acquirant; ea namque pars, quæ uteri vaginam excurrit, sinuosa est, & recta sursum producitur. Ambiens interius membrana aspera est, nam rotunda lateraliter habet orificia; hæcque admissum stylum non longius progredi sinunt, & interdum quasi glandulosi folliculi subrotundi appenduntur intro hiantes. Plures quoque per transversum extenduntur membranæ valvularum instar, unde in aliquibus appendices quasi cæcales excitantur, quales in intestino colon observantur. Prope urethræ orificium latiora redduntur hujusmodi vasa, & non raro sinuoso quodam capitulo turgent, a quo tortuosus ductus intra vaginæ concavitatem aperitur ita, ut gemina obscuraque orificia urethræ hiatui proxima pateant. Superior vasorum pars latera uterini oris excurrans involucro quasi cartilagineo custoditur, unde varicosa redditur, & appendices subrotundas hinc inde promere videtur, ubi præcipue ambiens vagina in dispersos globulos extuberrat; in quibus vero contento intus ichora turgēt, rectus efficitur tubulus; ablato enim cartilagineo involucro tennella vasorum membrana manifestatur. Emergens tandem a cervice portio, calami scriptorii magnitudinem & formam sortita firmo involucro, etiam per aliquod spacium ambitur; deinde spirali quasi ligamento circumdata elegantissimi vasis speciem adepta sensim decrescit, & subrotundas interdum promit lateraliter appendices succo refertas, & ulterius elongatur, donec prope cornuum curvaturam in ramulo laciniatur, quibus gracilescentis uteri portio irrigatur. Et quoniam admissum siphone

siphone atramentum vasorum extremos fines non subit ob contenti fortasse humoris visciditatem, ideo ultimus furculorum terminus non attingitur. Interdum loco propaginum appendices seu loculos observavi succo turgidos. Vasa hæc in prægnantibus una cum utero ita elongantur, & distenduntur, ut in vaccis ultra longitudinem brachii extensa viderim, multoque tunc temporis ichore turgentia, unde de facili obvia fiunt. Totam exaratorum vasorum concavitatem subpallearis succus occupat, qui variam tamen in diversis partibus & individuis substantiam sortitur; nam in sinuosa parte, quæ per vaginam excurrit frequenter mucosus est, & pultis instar semiconcretus non raro observatur; in reliqua vero productione terebenthinam colore & lentore æmulatur; ignique expositus copiosas excitat bullas, & tandem glutinosum charabis instar relinquit crassamentum.

Ut autem singula hæc pateant, tibi que obvia reddantur exarata vasa, avulsâ urinariâ vescica & ambiente membrana, sanguinea vascula & fibrarum implicationes detrahes ita, ut exterior uteri angustata portio, sub qua os latitat, cervix & cornua denudata pateant, illico enim tubulosa hæc vasa hinc inde ultra uterini oris situm, in cervice scilicet emergent, ipsorumque ulteriorem progressum supra cornuum latera attinges. Inferior vero horum vasorum portio tibi patebit invento eorundem hiatus in extrema vagina non longe ab urethræ orificio. Interdum contentus in his ductibus ichor transparet ita, ut si interior vaginæ superficies lustretur, latæ videantur lineæ per longum ductæ. Tacto itaque foramine stylus imitatur, qui sensim penetrando totam quasi vaginam excurret. Ut autem obscurior & intermedia horum vasorum portio & continuatio pateat, erumpentis vasis ex uteri cervice involucrum descendendo sensim secabis; contenti namque ductus sublutea membrana, semitam indicabit. Et licet vasa hæc gracilia & varicosa existant; sectis tamen per longum carneis fibris uteri & vari-

cofis globulis postremo tibi occurrent. Interdum ubi turgent ichor vasa hæc ampla & recta facillime obvia fiunt. Tu interim, summe vir, hac nostra indagine excitatus exaratorum vasorum structuram & progressum lustrare ne dedigneris, ut mature indicare valeas, an hæc vasa sint Laurentii, Riolani, & aliorum processus, vel deferentia vasa, an *Graafie Lacunæ*, an postremo *Gasparis Bartholini*, in quo Parentis, & Avorum rediviva gloria ulteriori nitore resulget, foeminarum prostata, an aliud novum. Hoc unum ingenue testari possum, mihi sola repetita multoties sectione tribus ab hinc lustris descripta vasa innotuisse; hæcque studia plurimis amicis indicasse.

Superatis vasorum, fibrarumque carnearum implicationibus & tunicis; secto secundum crassitiem utero in gravidis præcipue, spatium quoddam, seu interstitium interdum semidigiti per transversum occurrit, quod a reticulari contextura occupatur, qua subvitellina quædam corpora vasorum speciem habentia, prout videre licuit, ad interiorum uteri superficiem producta firman-
tur; circa hæc ludunt sanguinæ, minimæque propagines ita, ut quasi omentum excitetur. Uterus interius membrana quadam ambitur, quæ minima & innumera habet orificia glutinosum, mucosumque fundentia humorem, quo uterus ipse & vagina perpetuo madent. Quare compresso utero profilit hujusmodi mucosus ichor. Patent autem hæc excretoriorum vasorum ora, si diu interior uteri membrana aqua maceretur, & in ovibus præcipue obvia sunt; quare probabile est subvitellina exarata corpora his orificiis in uteri cavitatem hiare; an vero his minimæ appendantur glandulæ, licet sensus distincte non attingat, ratio tamen ex perpetua naturæ operandi norma probabiliter eas suadet. Observantur quoque quamplurimi in tota uteri & cornuum interiori superficie tumores inæqualis magnitudinis parum assurgentes, qui graviditatis tempore insigniter turgent, &
uteri

uteri appendices videntur, seu vaginalium congeries, unde cotyledonum nomine insigniuntur. Admittunt autem erumpentes a chorio subintrantes radices ita, ut ex his duabus infitis partibus completa habeatur glandula, qua separatim ab utero alimentum foetui subministratur. Taliter igitur compactum corpus, geminaque integratum parte placentulae, seu subrotundi, parumque depressi corporis speciem habet, varioque inficitur colore; ea namque portio, quae ab utero attollitur, cinerea est, altera autem subrubescit. Dimidiata uteri glandula congeries est vaginalium & sinuum, quibus alte perfoditur, unde atramento affuso manifestantur. Hujus substantia parum differt a velamento bombycino, quo intestina & ruminantium ventriculi interiorius obducuntur; subrotundas namque appendiculas promit, & compressa copiosum succum ptisanæ persimilem reddit. sanguineis vasculis irrigatur, unde injecto per uteri arteriam atramento tota denigratur. Interdum visus sum, obscure tamen, subflavum quoddam attingere vasculum, cujus ulteriorem indaginem tuæ sedulitati relinquo. Altera glandulae pars chorio adnata lacinatis quasi radicibus coagmentatur, quibus exaratas vaginulas subintrat. Tibi autem pulchrum occurreret spectaculum, si evaginata hujusmodi pars intra aquam diu contenta microscopio lustretur: sepatata enim radicularum & capillamenta sensim ita attolluntur, ut elegantem sylvam emulentur; innumeræ namque quasi plantarum radices a communi trunco propagantur, quæ in multiplices subdividuntur furculos & in capillamenta laciniantur. Harum substantia non differt ab uteri vaginalibus. & sanguineorum vasorum propaggines recipit ita, ut quælibet minima radícula suis gaudeat sanguineis furculis, qui per medium perpetuo ducuntur.

Uteri compages in mulieribus adeo obscura est, ut pene impossibilem sui indicet resolutionem; contracto namque utero ita complicantur & varicosa redduntur vasa,

fa, ut nullus sit locus sectioni etiam accuratæ. Ea tamen tibi indicabo, quæ ex repetitis sectionibus mulierum vel a partu, vel circa septimum gravidationis mensem defunctarum observare potui. In his igitur uterus crassitie digiti latitudinem æquat, & sanguinea vasa copiosa recipit, quæ ramis rete efformant. Exterius fibræ carneæ in fasciculos coagmentatæ, & reticulariter implicitæ uteri structuram componunt ita, ut ipsius interior etiam moles sit lacertorum congeries & complexus, qui variam sortiuntur inclinationem. Inter exaratas carneas fibras copiosæ extenduntur pelliculæ, seu molles tunicæ, supra quas ampli sinus fere innumeri, vasorum instar per longum excurrunt, qui in diversis planis superlocati, frequentibus orificiis ditantur quamcunque peripheriam spectantibus, unde inter proximos sinus fit mutua anastomosis. Horum speciem in mammarum tubulis, & in pene habemus; in his nonnihil sanguineis reperitur ita, ut videantur venarum diverticula, vel saltem ipsarum appendices: non longe ab his excurrunt sanguinei furculi non dispari ritu ac in liene accidit. Interior uteri substantia avulso chorio, & placenta, musculosa occurrit vario lacertorum complexu excitata, & a rimulis sanguinea vasa in furculos divisa promittit. Huic uteri superficiei graviditatis tempore pelliculæ quædam adnascuntur, quæ corio præcipue & placentiæ connectuntur; hæ molles sunt & mucosæ, facileque lacerantur. Ab his rete quoddam fulciri & produci videtur, quod cinereis quibusdam, & friabilibus componitur corporibus, quæ tereti forma pollent, & propagatis lateraliter ramis in retis formam implicantur, pisciumque omentum repræsentant. Circa hæc corpora sanguineæ ludunt propagines varicose ductæ, & versus chorion & placentam elongatæ. An exarata corpora reticulariter implicita, sint fibræ carneæ, an nervi, an satius excretoria uteri vasa, tu ipse judicabis. Occurrit placenta uterina una cum chorio firmiter utero annexa.

nexa. Placentæ compositionem integre attingere non licuit ob friabilitatem & mucositatem, variamque partium implicationem. Illud tamen videtur certum, placenta esse vasorum umbilicalium contenturam peculiari firmatam substantia. Et sicuti cotyledones propria donantur substantia, quæ sanguinea vasa fulcit, & eisdem loco cribri, vel coli infervit; ita placenta, quæ est aggregatum ex cotyledonibus, scilicet ex partibus uteri vaginulas subeuntibus, necessario congeries est radicum & furculorum vasorum umbilicalium, qui supra laciniatam glandulosam substantiam producuntur. Interdum visus sum sanguineis propaginibus rotundos globulos, seu glandulas, quales in renibus observamus, appensas attingere; immersa tamen in aqua placenta, non occurrere hujusmodi glandulæ, sed laciniata tantum corpora sanguineis vasculis irrigata observavi, quæ plantarum radículas æmulantur. Uterinæ placentæ superficies, qua utero nectitur, inæqualis est, nam videtur appendicibus subingredi uteri sinus & concavitates quasi cotyledonum ritu.

Uterorum forma in singulis fere animalium specibus varia est, & ab Anatomicis tam graphice describitur, ut nostram non exigat expositionem. Illud tamen perpetuum videtur, tubis ditari, quæ in plantarum uteris præ reliquis luxuriant. Non longe ab ipsis ovaria locantur, quæ antiquitus testes censebantur. In vaccis, in quibus ampla & manifesta extant, obducta membrana fibris carneis firmata ambiuntur. Qua ratione ovum ab ovario emergat, & in tubas transducatur, sollicita multaque eget indagine. Quæ tamen ex fortuitis ovarii in vaccis lustrationibus colligere potui, tibi brevibus aperiam; non enim licuit, ut in incubatis ovis, successivam observationum seriem ex maculatis statim tempore quamplurimis quadrupedibus attingere, cum regias fere impensas exigat, quod *Harveo* & paucis concessum scimus, Illud itaque certum videtur in tenellis & adultis quadrupedibus

quadrupedibus & præcipue vaccis, ovaria complures continere inæqualis magnitudinis vesiculas colliquamento turgidas, quod igne in albuminis ovi naturam concrefcit. Non semel vidi ab ovario pendentem vesicam, quæ magnitudine gallinaceum ovum superabat, & albumine concrefcibili referta erat. Vesiculæ hæc tunica satis densa muniuntur, cujus interiorem superficiem (ut non semel observavi) sanguinea vasa miris plexibus irrigant. Tractu temporis luteum, solidumque corpus emergit, in tantam excrescens molem, ut totam quasi ovarii partem papilla quadam protuberat; magnitudine, completo augmento, cerasi fructum æquat. Exterior superficies aspera est nonnullis exiguis tumoribus inæqualibus excitata, fibris carneis ambitur, quæ ut in glandulis observatur, interius sese insinuant. Vasa quoque sanguinea & nervi excurrunt. Membrana involvitur, præcipue in papillari appendice, quam communis ovarii tunica ulterius investit. Componitur exaratum corpus frustulis & quasi lobulis, ut in aliis visceribus admirati sumus: hi autem angulosi sunt & variam sortiuntur inclinationem; videntur enim appendi sanguineis vasculis, & producto quasi umbilico. Lobulorum compages obscura est, & varicosis propaginibus lutei coloris conflatur, quibus videntur subrotunda corpora & appendices aurei coloris, & quasi adipis minima frustula necti & continuari. Interior configuratio exarati lutei corporis non eadem omnino quocunque tempore reperitur, sed varia occurrit. Interdum enim, ut a simpliciore exordiar, conglobatum, implicitumque observatur corpus varicosis productionibus lutei, quandoque subcinerei coloris contextum, quod vix granum milii, vel saltem viciæ excedit. Frequentius tum circa vesiculas colliquamento, seu albumine ovi turgidas, adhucque minimas exterius involucrum lutea substantia compactum & quasi capreolis excitatum obducitur. Non raro luteum hoc corpus magnitudinem ciceris pene adeptum

deptum, pyrum figura æmulatur, & interius a centro versus collum sensim angustatum finem habet colliquamento turgidum. Sæpe acquisita magnitudine fructus ceraforum, exteriori papilla ab ovario erumpens vesicam colliquamento refertam, mulei instar ceraforum, in centro continet, quæ interdum rotunda est, & non raro pluribus styloformibus appendicibus donatur, frequentius tamen una tantum gaudet appendica. In completo quoque luteo hoc corpore interdum nil fere occurrit contenti colliquamenti, sed frequentissime ab interiori tunica papillam investiente, ubi fovea exterius ut plurimum excitatur, & foramen postremo excavatur, cinereum quoddam corpus producit membraneum, & fortasse fistulosum, quod versus centrum perpendiculariter elongatum in ramos vasorum instar dividitur, qui universam lutei corporis compagem excurrunt, hisque appenduntur lobuli sub diversis inclinationibus. In aliquibus adultis luteis corporibus versus centrum, & quandoque profundius ovulum cum appendice magnitudinis grani milii observatur exarato cinereo corpore contentum. Sæpe meatus quidam, seu ductus aperitur a profundo usque ad papillæ centrum productus, in quo diaphanus stagnat humor, qui igne in albumen concrevit, & non raro ovulum, vel gemina custodiuntur appendice donata, non valde dissimilia quo ad formam ab his, quæ in muscis gallarum observantur. Postremo tandem lutea hæc corpora effæta deprehenduntur. tinuoso ductu pervia, qui a papillæ medio foras hiat ita, ut stylum admittat: inclusa vero cavitas magnitudini pisi æquatur, & ambiente membrana una cum continuato ductu investitur. Hæc itaque in diversis constitutionibus deprehensa, probabiliter evincere videntur, luteum hoc corpus non solum pro custodia ovuli, ejusque ejectione a natura excitatum esse, sed fortasse ejusdem generationi conferre, hincque glandulosum po-

tius, quam musculosum censendum esse; ejus enim structura non est fibrosa, nec carnea, sed potius succenturiatis renibus persimilis; unde probabiliter dubitari potest per glandulosum hoc luteum filtrum præparari, & separari materiam, quæ transmissa per ramos umbilicalis vasculi, tandem in ovulum, seu præviam cicatricem ichore contentam immutatur. Hujus analogam productionem in plantarum ovis intuemur, in quibus umbilicale vas primo emergit, cujus extremitas sensim laxatur & turget ex subingresso colliquamento, quod tandem plantulam manifestat. Ex his quoque dubitari potest, vesiculas, quæ quocunque tempore in ovariis copiosæ luxuriant, inæqualem sortitas magnitudinem & concreffibili colliquamento plenas, non esse vere ova, quæ postremo foecundentur, sed materiam, ex qua fortasse glandulosum, luteumque corpus primo excitatur. Non enim videtur certum, post coitum tantum, seminisque masculini affusionem, luteam & glandulosam manifestari substantiam, & hanc foecundati inclusi ovuli signa præferre; nam frequentissime in vitulis nuper natis unam, vel alteram vesiculam insignem deprehendi, cui lutea hæc substantia graminis instar adnascabatur. In vaccis quoque prægnationis præcipue tempore, & in diversa contenti foetus ætate, lutea hæc corpora interdum ciceris, modo cerasorum fructum æquantia in ovariis observavi, & hæc multiplicia, nec tamen superfoetationis suspicio aderat. Hoc idem in muliere circa septimum graviditatis mensem observavi, quin & in uno eodem ovario in diversis animalibus plura lutea hæc corpora inæqualis magnitudinis extant, in quibus non succedit tanta foetuum multiplicitas. His addam in pluribus ovariis, concoctis præcipue, vasa ampla luteo succo concreto turgere. Dubitari quoque potest, non unicam vesiculam albuminis absumi pro generatione lutei unius corporis, sed fortasse plures insumi;

mi;

mi; nam ubi perfectum extuberat luteum hoc corpus, non solum totam fere ovarii concavitatem occupat, sed frequenter paucae albuminis vesiculæ adstant, cum alias copiosissimæ numerentur. His itaque pensatis non improbabilius colliges, luteam hanc, glandulosamque substantiam non immediate subsequi seminis affusionem factam in ovo intra ovarium contento; sed longe ipsum antecedere, & subventanea quoque dari ova, vesiculas pariter colliquamento refertas non esse rigorse ova, sed materiam, ex qua glandula excitatur, cujus ope ovum separatur, fovetur & stato tempore cicitur. Erumpit autem ovulum, forasque truditur, dum extuberans glandulosi corporis papilla ex carnearum fibrarum contractione extra magis exprimitur, & lacerata sensim tenui ambiente membrana, hiante umbilicali vase, vel sinu, conditum ovulum foras exprimitur; Interdum etenim papillam præputii instar a carneis fibris ovarium ambientibus revulsam vidi, unde patebat hiatus in concavitatem glandulosi corporis: ovulum autem, ut in gallinis accidit, contractis carneis lacertis, quibus reticulare opus infundibuli, seu extremæ tubæ conflat, abunde & secure excipitur, ut in tuba foecundetur. Extruso itaque ovulo sensim flacescendo contabescit glandulosum corpus, & de facili obliteratur, sicut angustatis arteriis & venis glandulæ & viscera quoque fere abolentur.

Hæc itaque uteri structura dubie & tumultuarie a me exposita tuam desiderat operam, ut obscuriora dilucida reddantur, & certa ulteriori indagine firmentur. Tibi igitur post novas aggressiones vera uteri structura patebit, & ignotam adhuc ovi foecunditatem, foetusque auctorem tua tandem dexteritas aperiet. Expositam interim uteri compagem meditantem mihi quædam probabilia proferre licebit. Uterus ex natura sua ve-

getationis ager est, in quo sata semina, seu ova, foventur, & viventis partes explicatiores redditæ manifestantur & firmantur; & licet a parente foemina ovum decidat & feratur, inefficax tamen & satuum est, ideoque masculini seminis energiam exigit, a quo vegetationis principium inchoetur: quare ex naturæ legibus mulieres, sicut & reliqui viventium ordines ova promunt, quæ uterino sinu recepta, & masculino semine foecundata in novum animal explicantur. Qua ratione autem in viviparis præcipue contingat ovi foecundatio non eadem apud omnes invenies sententiam; plerique enim censent, seminis corpulentiam ovo ipsi, ovario adhuc appenso peculiaris cujusdam ductus ope affundi: alii vero jam delapso, intraque uteri claustra concluso aspergi autumant; & postremo nonnullorum est firma opinio, immutato totius uteri tono, infectoque sanguine a virilis seminis aura, tandem conclusum ovum foecundum reddi. Constat autem, Tibique diversos animalium uteros secanti sæpius patebit, anfractus & obstacula occurrere, quibus seminis corpulentia ingressus in uteri concavitatem intercipitur. In vaccis ichor quidam & lentus extillat mucus; seu gelatina, qua non solum interio uterus madet, sed ejusdem os obturatur, & superior vaginæ portio refertur; quare sicut seminis corpulentia ingressum prohibere potest, ita ejusdem auræ, & spirituosius habitibus menstruum & vehiculum opportune subministrare probabiliter potest. Extillans igitur ichor ab exaratis superius osculis, quibus uteri & tubarum interior concameratio pertunditur, non solum totum uterum & vaginam irrigat, sed effuso intra vaginam semini occurrit, ejusque volatiles particulas coercendo sibi intime miscet, a quibus tandem fermentatur & turget. Hæc motio media partium contiguitate continenti utero communicatur, ejusque fluidis particulis impertitur ita, ut in utero & contentis humoribus

bus novus tonus, copulationes & motus succedant. Receptum igitur ab ovario media tuba ovulum sufficienter irrorari potest, & energetico illo masculini seminis spiritu foecundari, a quo motus principium manifestari incipit. Hinc *Hippocrates* fortasse ficos, vel plus justo humidos uteros steriles dicebat; in illis enim geniturae vis non coercetur, nec propagatur; in his vel dissipatur, vel effluit ita, ut in temperatis tantum conceptus subsequatur. Quid simile miramur in papilionibus, in quibus ingens bicornis vesicula extremo appenditur ovario, a qua glutinosus perpetuo extillat ichor in concavitate vaginæ, quo masculinum semen, aliisque etiam a laterali loculo eructatus humor excipiuntur & foveantur, quibus omnibus pertranseuntia ova irrorantur & foecundantur, & ita per plures dies plastica illa vis conservatur, & subsequentibus diebus excurrentibus ovis communicatur; quod pariter in gallinis coniectari licet, in quibus seminis semel recepti energia non parum conservatur ita, ut successive etiam tempore ova foecundentur. Et quoniam natura in gallinaceis non solum cicatrici, in qua partium rudimenta latent, galli semen, vel aliud menstruum ab eodem foecundatum aspergit & affundit, sed totum ovum, alimentum scilicet sub specie albuminis & vitelli vi plastica irrorat ita, ut totum foecundet; ideo cum uterus humoribus turgidus ovulum ambiens analogus sit gallinarum ovo, ipsum quoque una cum contentis humoribus foecundari probabile est; hoc autem interius extillans ab utero ichor semine turgidus prestare potest. An vero uterina vasa superius exposita huic foecunditati aliquid conferant, dubitari potest. Et primo probabile est, contentum succum foeminei seminis, vel saltem prostatarum ichoris loco esse, & inde incitamentum & propriam energiam una cum masculino semine ovo communicare posse. Quoniam tamen hæc vasa per longum uteri producuntur,

producuntur, & extremis finibus ejusdem cornua irrigant, glutinoso pariter succo turgent graviditatis præcipue tempore, ideo mihi dubitandum occurrit, masculini seminis volatilibus particulis non parum immutari contentum in hujusmodi vasis humorem, indeque exteriores, & præcipue cornuum partes foecundari, in quibus fit primæva conceptio, & successivo foetus auctio & nutritio. Nec tibi improbable hoc videbitur, si mente revolves, hujusmodi humorem masculino semine de facili alterari, cum passim ex unico, soloque concubitu cum lue venerea infectis totus ita inquinetur humor, ut acidior redditus perpetuam sibi viam affectet, & semel inspiratum miasma diu conservet. Delapsum itaque ab ovario ovulum, & menstruo uterino utriusque seminis volatilibus particulis turgido aspergitur. Uterus quoque interius & exterius, contentique in eo humores ita turgent, ut sanguis novo recepto motu intra vasa non parum subsistat, cotyledones extuberent, & fluvidis redditis, & ad motum propriis omnibus inclusi in ovulo foetus nutritio & auctio calebrentur.

Varia est natura in mechanico illo apparatu, quo a vasis uteri in foetum succus transducitur; nam placenta, vel quid analogum frequenter intercedit. Exarata cotyledonum structura superius exposita præ reliquis elucescit; est enim sui generis glandula globata, in qua portio uteri propria carne donata receptum ab uterinis arteriis succum percolat, qui separatus in sinuosis cavitatibus recolligitur, donec sensim fistulosas alterius glandulæ partis radículas subeat, & venarum furculis excipiat. Sed potiora mentis tuæ, cultrique acie deteges ita, ut ulterius non liceat meis cogitatis tuam præoccupare phantasiā.

Ab animalibus interea ad vegetantia transitum faciens cursum quædam recolligam, quæ in dictorum alias confirmationem denuo observavi. In plantis igitur nutritii succi motum exploraturus iterum in multiplicibus, variisque arboribus corticem vinculo, vel circumcissione, avulsa ejusdem anulari portione tentavi, & plantæ superior portio, ultra scilicet sectionem perpetuo intumuit, debitumque sortita est augmentum; inferior vero nullum adepta incrementum solas interdum dedit gemmas. Hanc eandem sectionem in humiliori trunci parte, & in radicibus ipsis excitavi, & perpetuo superior trunci, vel radicum pars insigniter intumuit, & ab hac radicula copiosæ emanarunt; inferior vero, reliquaque radicis portio frequenter gracilescendo tandem contabuit: Quare confirmari videtur indicatus olim nutritii succi refluus motus ab extremis ramis ad ultimas usque radices; unde intercepto alimento compressione, vel laceratione vasorum remotiores plantæ partes solito non gaudent alimento, tumorque ex relabente succo excitatur. Propagatur autem a foliis ipsis usque ad radicem extremos apices. Quapropter florum cultores soluto in girum cortice, ut alias indicavimus, tenellum ramum a paterno emancipant trunco circum affusa madida terra, in qua erumpentes novæ radiculae supra sectionem vegetare incipiunt; alimentum enim inferiora versus propulsum, vel expressum non solum prope corticis sectionem stagnando tumorem excitat, sed foras irruendo in radículas absimitur; unde sui juris factus furculus paterno tandem dissociatur trunco. Non raro in radicibus prope flumina, quarum portio obtruncata aperto gaudet aere, ab ultimis libri finibus gemmæ radicum loco erumpunt, quæ in ramos sursum attolluntur. Hæc sunt ea, Vir doctissime, quæ tibi indicanda erant, & quæ
tuis

tuis exulta ac firmata observationibus stabunt, diu-
que vivent; Tibi enim familiare est lapides ipsos &
priscorum monumenta injuria temporum attrita no-
va eruditionis luce donare, & ab interitu vindicare.
diu vivas, dum me tui addictissimum profiteor.
Vale.

Dabam Bononiæ calen.

Novembris MDCLXXXI.

A Let-

A Letter from the Learned and Ingenious Maurice VVheeler M. A. and Rector of Sibbertoft in Northamptonshire, to the Publisher of these Tracts, concerning a Movement that measures time after a peculiar manner, with an Account of the Reasons of the said Motion

Hon. SIR,

THE Relation which I have, and the great Respect that I bear to the lately erected *Philosophical Society* in *Oxford*, will ever oblige me to serve it in the meanest offices, if thereby I may contribute the smallest Advancement towards that noble Design they are in pursuit of. Wherein, forasmuch as an Attempt is vigorously (and in the issue I hope successfully) carried on, by the communicated Observations and united Counsels of ingenious and learned Persons in this and other Nations, to improve the knowledge of things to the real use, or (at least) the sober delights of mankind by your encouragement; I have herewith (and as my first tribute,) presented to the consideration of our Society, the Scheme and Contrivance of a *Movement*, which measures time indeed by *Number, Weight and Measure*; but after a manner so peculiar, and in several of its properties so surprizing, and of a structure so unexempl'd; as you your self (if the invention be worth the owning) can vouch me to be the sole Author of. For altho the late *Lord Marquis of Worcester* is said to have contriv'd a Watch that should move upon a declivity, as this (hereafter describ'd) is intended to do, and *Monsieur de Gennes* in the *Philosoph. Transact.* Numb. 140. has given some account of a *Clock* ascendent on a *Plain* inclin'd. yet neither of them, nor any like them, was ever seen by me, and for ought I could ever learn, the *Reason* of their *Motions* remains

to this hour as great a Secret, as if they had never been.

Now whether I have discover'd this or no, will appear from the Account I am now about to give thereof; which I shall deliver with all the clearness I can in this method following. 1. By proposing the State of the *Poblem*, or declaring what is to be done. 2. By offering at a Solution thereof, and shewing from allow'd Maxims in *Statics*, and other Principles proper to the Question in hand, the Reasons how, and the Causes whereby it may be effected.

1. The state of the *Problem*, may be compriz'd in these four particulars; by describing 1. The *Movement* as to its exterior structure 2. The manner of its motion, as it appears to the Eye. 3. The use thereof in the measuring of time. 4. The way of adjusting this Motion to the exact divisions of an hour. All which foremention'd particulars (were the *Movement* actually made,) would be obvious to the apprehensions of any Spectator, who perhaps might never be able to comprehend the Reasons of the Motion it self.

1. For the exterior structure of the *Movement*, be pleas'd to see *Fig. 3.* which represents a circular body of 3 inches $\frac{1}{2}$ diameter, consisting of 2 plates measur'd by the same *Radius*, and fixt in a parallel position to each other by the hoop, (*b.*) the bredth of which is about an inch. This hoop and the 2 Plates form the Case of the *Movement*; of which, that which appears in the front, is towards the verge thereof inscrib'd with a horary circle, the divisions whereof answer the hours of a natural day. The deep shades within this circle are intend'd to represent a Concave, of near half an inch deep; and the prominence (*g.*) in the middle of this Concave, is a hemisphere of Brass or Silver, riding loosely on a pin, which lies hid, and is the *Axis* of the *Movement*. The upper half of this hemisphere is hollow, but the nether fill'd with Lead; and the small Gentleman that sits thereon, does with an erected finger perform the office of an *Index*. The Reason why this

plate is concave, is grounded upon no necessity; but since the structure of the internal parts will very well admit of such a figure, and it comported pleasingly with a fancy I had of rendering the front of the *Movement* more beautiful, therefore *currente rota* (as the Poet speaks,) I gave liberty to my pensil to describe it in this manner. But if the hemisphere with the figure thereon, shall seem a piece of work too elaborate for the end it serves unto; and for the sake of which the Dial-plate is form'd into that shape: I have (*Fig. 4.*) drawn a plain *Index*, which you may substitute in the room thereof, or any other, (as it shall please the Painter) provided that the *Axis* whereon 'tis supported, move freely in the hole (*H*); and the lower part thereof *H. I.* may so far preponderate to *H. P.* as always to keep the *Index* pendulous, with its point to the vertical hour.

2. For the manner of its motion, as far forth as it appears outwardly, it is thus; *S. E. Fig. 3.* represents a board or shelf, of a strait and even surface, about 6 foot long, and so thick as not to be apt to cast with change of weather; nor to grow *Camber* under a small weight; on this is the *Movement* plac'd and here to perform its course, and therefore I call it the *Stage* of the *Movement*. This *Stage* is rais'd at the end *S.* about 10 degr. above the Horizon or line of level *H. E.*; but the Angle of its declivity *D. E. H.* is variable, as will hereafter appear; and although it happens in the Scheme to be 10 degrees, yet I would have it understood to be indefinite at present, till I come to shew the causes that will determine its quantity. The 2 plates which form the Case of the *Movement*, are to be extant all round without the hoop (*b.*) $\frac{1}{2}$ of an inch, and the edges of 'em lightly indented; that while the *Movement* descends upon the *Stage* it may turn only, and not slide.

3. The use thereof in measuring time, is as follows. The *Movement* being plac'd as high as it may, near the point (*S.*) shall move downward towards *E.* with that

flownes, as to finish one entire Revolution in 24 hours; and while it does so, the divisions on the horary circle (or Dial-plate) successively culminating over the point of the *Index*, will show the hours of the day and night. For in this Movement (contrary to what is usual in others) the hour is discover'd by the accels of the numbers to the *Index*; which (as was said *Par. ic. 1.*) is always to keep the same Position. Now when by several repeated Revolutions it has measur'd out the length of its stage, it is to be replac'd at *S.* as before; which may be done in less than half the time you are winding up a Watch; and if the stage be but 6 foot long, no oft'ner then once in a whole week.

4. The way of adjusting this Motion to the exact measure of an hour, and rectifying its errors; comes in the last place to be provided for. No Movement could ever yet be found, that would keep pace with the Sun; and the Reason of this, besides the alteration of weather, and other common accidents to which the most curious Movements are liable; is because the Sun it self does not always keep the same pace, nor is the precise duration of a solar hour in any one day so exactly assignable, as to serve indifferently for the whole Year round. But leaving that *Astronomical Enquiry* to such as have better helps and opportunities for Celestial Observations; I shall crave leave to think, that if no greater objection can be rationally made to this Movement, then the necessity of its being sometimes adjusted and rectify'd; even this will appear a very inconsiderable one, since the manner of doing it, is so very obvious and easie. To explain this, 'tis to be consider'd that there are two Errors which every Movement is subject to, and indeed scarce ever entirely free from, tho when the aberration is so small as not to be discernable, it passes for truth. The first of these is, when a Movement gives you a wrong measure of an hour, by going remarkably too fast or too slow; and this is an error in the whole train of the Movement from the beginning to the end. The second Error is,

when

when the *Index* points to a wrong time ; and this happens either 1. By consent, when it follows the Error of the Train; for while the Movement goes too fast, or too slow, the *Index* can never be right. Or 2 It is a *Solitary Error* in the *Index* only, when the motion of the Train being duly adjusted, the *Index* it self is not set exactly to the (*to vov* or) present instant of time on the Dial-plate.

1. Therefore, to remedy the former error which lies in the whole Train ; we nick our Watches up or down (as the case requires) by turning the endless skrew, or by removing (either forward or backward) the *Retinaculum* or Brace of the spiral spring ; and in *Pendulums*, by giving the Boss a turn or two upwards or downwards : but in this Movement (if so be it shall happen to prove one,) the adjustment is readily perform'd without ever tampering with the Movement it self ; for by a skrew inserted in the *Stage* at (S) with the turning of which the *Stage* may be elevated or depre's'd, I affirm that the Movement will go faster or slower : faster, if raised up ; and slower, if let down.

2. The motion of the Train being thus adjusted (as near as may be) to the true measure of an hour, the error of the *Index* will be rectifi'd thus. I said before, that the *Index* is always to hang in the same position, and therefore cannot be turn'd to the time, but the time must be brought to it ; which is readily done by making the *Horary Circle* movable, and inserting several small bosses or buttons here and there upon the verge thereof whereby (with an easy touch of the finger) it may be stirr'd to the right or left, as there shall be occasion.

AND thus 'r. you have the *Problem* propos'd, and nothing material omitted in the description of the intended Movement, either as to its external structure, or the manner how it moves in the measuring of time, or the way how it is to be adjusted and rectifi'd: You have heard both what it will do of it self, and what is to be done with it ; in all which I affirm it will fully answer your expectations and mine, for proof whereof I hasten to the remaining part of my discourse, which contains,

II. THE SOLUTION of the *Problem* propos'd ; wherein I shall endeavour to show from allow'd Maxims in *Statics*, and other Principles proper to the Question in hand both the Reasons how, and the Causes whereby this may be accomplish'd.

1. Then, because it may seem at first view a little surprizing, that a circular body should rest (or which in the present case is all one, move so imperceptibly slow) upon a descending plain, having no visible impediment either to stop or retard

tard the *impetus* of its own weight: therefore to explain this, be pleas'd to see *Fig. 2.* where first. Let the circle (*L. O. D. N.*) represent any circular body whose centers both of gravity and magnitude are coincident at *M*. Let this circular body be plac'd upon some level plain *GG*. and then 'tis evident that the Angle of its contact with that plain at (*a.*) will also be the point of its Libration, and consequently it must needs rest there; *Quia momentum & impedimentum sunt equalia.*

2. Let *DE* represent a descending plain, making an Angle of contact with this circular body at (*b.*) and here, 'tis manifest it cannot rest; because the *Line of Direction* (*ra.*) which (while it infisted on a level) divided the circular body by the centers of magnitude and gravity into parts æquiponderate, is now remov'd to *LD*; which line *LD* falling without or beside the center *M*. evidently destroys the æquipoise of its parts, and therefore must leave it to tumble down towards *E*. for here *Momentum impedito majus*. The reason therefore of its descent now, being the overbalance of the parts *LND*. to the remaining Section *LDO*. it must necessarily follow.

3. That if some weight equal to the excess of *LND*. above *LOD*. were affixt to the limb of the Quadrant (*O, a.*) as at *P*; then the circular body would rest as quietly at (*b.*) as it did before at (*a.*) The supposition cannot be denied, and the consequence is unavoidable, because $LDO + P = LND$. i. e. *Impedimentum æquatur Momento* Nay I affirm that this circular body shall now resist a greater force, and maintain its point of libration (*b*) more pertinaciously on the declivity *DE*, then it could before, when it rested on the poynnt (*a*) in the level *GG*. The reason of which, is evidently this; because by the addition of the counterpoise *P* to the Quadrant *Oa*, the center of gravity falls lower in the line of Direction *LD*, and is remov'd from *M* to *C*, i. e. nearer to the poynnt of libration (*b*): and consequently will keep the circular body more steady in its present Position. From whence if it be remov'd about 7 or 8 degrees of the Quadrant from the poynnt of Libration (*b*) either upwards or downwards by a motion of volutation, it will vibrate briskly till it recover its poynnt of quiescence: whereas any globular body having the same centers of Magnitude, and Gravity, and infisting on a level; as it is turn'd with a very light impulse, so as soon as its circular motion ceases, it never undulates one jot, but rests immediately.

THUS it appears evidently (as to me it seems) how such a circular Body as is describ'd *Fig. 3.* may be made to rest upon the descent *SE*: which if I have prov'd, more than half the difficulty of the *Problem* is solv'd; for what I have already

dy offer'd towards it solution, has been but as it were the winding up of the Movement in order to make it go; and it will appear from what follows, *That the same principle, which hitherto has bin the cause of its REST, shall from henceforth be the cause of its MOTION.* To this purpose, be pleas'd to observe *Fig. 1.* where the same Movement, which was sciagraphically describ'd *Fig. 3.* is for the better discerning its internal structure, and explicating the reason of its motion, represented in naked lines. Here then, let the numbers 1, 2, 3, 4. represent a train of wheel-work, wherein there is no material difference from what is found in a common Watch; only the numbers of the teeth on the wheels and pinions are to be so calculated, that the motion of the whole train may correspond to the assign'd Revolution of the body of the Movement, which is to be once in 24 hours. It would be expedient also, that a spiral spring were applyed to its Ballance, as in the latter Movement is usual; but of a *Use* here's no need, for the turns of the body of the Movement as it descends upon the Stage, answer all the intentions of a string or chain; and the contranitence of the weight *P* to the excess of *LED* above *LQD*, serves instead of a perpetual spring; and the Movement wants only a perpetual descent, to make its motion so. And whereas the great wheel in ordinary Movements, is plac'd as near the edge of the framing plate (*ff*) as it may be; here it must (with its *Axis* or *Arbor M*) possess the center of the Movement: because this wheel is to carry the weight or power *P* by the *Vestis MP*, and that weight *P* must always keep an equidistance from the center of the Movement, that while the body thereof (*i. e.* of the Movement) performs its Revolutions; the said weight *P* and the great wheel (to which it is affixt,) may without any considerable variation, continue in or near the same Position, wherein they now are. Now for a while; be pleas'd to suppose this weight *P* with its *Vestis MP*, to be taken quite out of the Movement, and laid aside: and then conceive the body of the Movement to be plac'd on a Horizontal plain *HH*, its point of contact in that plain where it should, but cannot rest, is *T*; because the weight of that part of the Train mark'd with the numbers 2, 3, 4 removes the center of Gravity from *M*, and therefore on the opposite part of the Movement as about *C 2*, the inside of the hoop which forms the Case is to be loaded with a thin lining of lead, which may be a counterpoise to that part of the train; that so the whole body of the Movement, together with all its furniture within and without (excepting only, that *P* with its *Vestis* is as yet laid aside;) may on that Horizontal

horizontal plain, or while it rides upon its own *Axis*, rest indifferently in any poynt. This reducing of the Movement to an equilibration of all its parts in the center M, must be perform'd *tentando*, i. e. by rasping the lead at C Q, as much and in such places as is needful; which to an Artificer of ordinary sagacity, will not be at all difficult.

THE center of gravity being thus reduc'd to M, the next thing that follows, is the replacing of the weight P; which, for the better representing its shape, is drawn according to the dimensions of its solidity as *Fig. 5.* and by the hole H, is to be set on the *Arbor* of the central wheel M. Now let the body of the Movement be plac'd on the Declivity D E, and supposing (as was shew'd above *numb. 3.*) $P + L QD = LDE$. then the body must needs rest there: but because the weight P is not now (as in *Fig. 2.*) fixt to any part of the Quadrant QD, but hangs upon the train of wheel-work 1, 2, 3, 4. it evidently follows that if the power thereof be superior to the resistance of the train, then the whole body of the Movement must needs descend towards E in *Fig. 3.* By this you see there are 2 offices assign'd to the weight or power represented by P in *Fig. 1.* or *Fig. 5.* whi h if I can make evident it will perform, I conceive this will be a complete Solution of the Problem. The

1. Is, to be a counterpoise to the excess of the weight of L E D, above L Q D; which that it may be, upon the reasons given in the explication of *Fig. 3.* I now crave leave to take for granted. The

2. Is, that it be of force sufficient to put the train into a motion so adjusted, as may exactly comport with the time assign'd for the revolution of the whole body. So that if there be any difficulty remaining, it consists in such an exact stating of the weight and power of P, that it may adequately serve both these intentions. Now how very easy this is, will be manifest from these Propositions following.

1. That whatever the intrinsic weight of P shall be, (as suppose it 4 ounces Troy;) yet the power of that weight will be augmented or diminish'd according to the different degrees of its elevation in the Quadrant T Q. Thus considering P M as a Vectis, its *Hypomochlium* (for want of an English word) is M, the point where it exerts its power on the train, is at V, I say then, that whatever power it has upon the poynt V in its present elevation of 45 degrees; it will acquire a greater by being rais'd to 50, 55. &c. and the greatest of all in 90 degrees at Q: and on the contrary, let it sink to 40. 35, &c. its power upon the point V will still be diminish'd, in so much that in T it will be utterly extinguish'd
and

and in respect to any influence upon the train, 'tis in that position (as the Poet speaks) *Necquicquam nisi pondus iners*. I need not spend time to demonstrate this Proposition, considering to whom I write; and therefore upon the presumed concession thereof, this consequence must be allow'd: that if P be of a competent weight (*i. e.* not utterly too light) to move the train at all, it will certainly move it in some degree of Elevation or other in the Quadrant QT.

2. If the weight P be consider'd as to its office of being a counterpoise to the body of the movement; as I need not prove, that it will perform this no less while it hangs by upon the *Vectis* MP, then if it were fast rivetted in the same place to the case of the Movement: so I affirm, that in what point of the Quadrant soever it will move the train, it may be also a counterpoise to the Body of the Movement. This proposition is not altogether so evident, but most certainly true, as I hope in what follows clearly to demonstrate. Be pleas'd therefore, to observe

1. That at what point soever of the Circle LETQ *Fig. 1.* the line of Declivity DE makes an Angle of contact; on the same point will the Diameter SD fall at right angles with DE.

2. That the line of direction LD will ever fall upon the point of Contact D, making an Angle with the Diameter, as SDL. These 2 propositions need no proof.

3. That the Angle SDL will be always equal to DEH in *Fig. 3. i. e.* As great as is the elevation of the line of Declivity DE above the Horizontal EH *Fig. 3*: so great will the Angle of distance be between the Diameter SD and the line of direction LD *Fig. 1.* To prove this see *Fig. 2.* where let EH represent the Horizon, ED line of declivity; to EH draw parallel *eb*, and to ED parallel *bd*. therefore Angle *dMb* is equ. to DEH, and *eMb* equ. to *dMb*; and because S Mb and *rMe* are right angles, therefore is S Mr equal to *eMb*, and *ra* being parallel to LD, the Angle SDL must be equal to (SMr, = *eMb*, = *dMb*, *i. e.* = to) DEH. and from hence it follows.

4. That the greater the Angle of declivity is in *Fig. 3.* the less will the Section LQD be in *Fig. 1.* and so on the contrary, the less that Angle is, the greater the Section. And therefore,

5. The excess of the weight of LED above LQD must be also greater, by raising up the stage with the screw at S: and that excess less, by screwing it down.

6. The lighter that part of the body is, which is represented by the Section LQD; the more heavy ought the counter-

counterpoise P to be, and that either in its owne 'intrinſick weight (in Ounces and parts of Ounces) or elſe in its potential weight, by being rais'd higher in the Quadrant Q T.

7. The ſkrewing up the Stage of the Movement at S *Fig. 3.* will raiſe the Counterpoise higher in the Quadrant Q T. by *Prop. 3* and therefore potentially heavier. And from hence appears (I take it moſt clearly) both the reaſon of the due adjustment of the motion of the Train to the exact meaſure of an hour, and what weight is to be aſſign'd to P, that moves it ; and that we are not confin'd to ſcruples and grains, but are allow'd ſuch a conſiderable latitude, as it is not eaſy to erre therein. I ſhall give a word or two for direction in that Particular and conclude. Therefore having ſet the Stage (by the help of the arch'd Skrew) at the elevation of about 10 degrees ; place the Movement thereon, and try what weight hanging at the end of the *Vectis* MP while ſtir the Train, meanwhile holding the Movement with the hand in ſuch a poſition, as the *Vectis* may make an Angle of about 30 degrees with the perpendicular MT: then let the Movement looſe to undulate upon the Stage ; and when the vibration ceaſes, obſerve to what degree of the Quadrant the *Vectis* poyns, and at the ſame time mind the pulses of the Ballance. If at this Obſervation, the weight lies low (as for inſtance between 25 and 35 degrees of the Quadrant) and the beats of the Ballance are gueſſ'd to be not much different from their due time ; the weight P is well enough proportion'd ; for herein (as I ſaid) there is a conſiderable latitude, and if it chance to be much heavier then is abſolutely needful, that exceſs will be moderated by ſkrewing down the Stage ; and if it be not abſolutely too light, its defect will be compensated. by ſkrewing the Stage higher. Therefore of theſe two extremes, chooſe the former ; for the fewer degrees that P ariſes in the Quadrant beyond what is abſolutely neceſſary, it will (for reaſons very obvious) be ſo much the better.

And thus Sir, if I have not err'd in my apprehenſions ; you have preſented to you the Scheme of ſuch a Movement, together with the demonſtration of it's Motion, as will fully answer the Problem propos'd. Upon the careful review of what has bin ſaid, tho I find ſome defects in poyn't of method, and not alwaies ſo natural a Syntax in the periods as might have bin : Yet I thing neither of that conſequence, as to render my meaning any where unintelligible, or my reaſons leſs concluſive ; tho both of them I acknowledg to be ſuch faults, as not to deſerve your pardon without a juſt excuſe. I have drawn conſequences from ſome aſſertions not prov'd,

prov'd, because I judg'd them unquestionable to any that know the undoubted principles upon which they are founded: and it would have bin an unpardonable trifling with your patience, upon every occasion to demonstrate $2 + 3 = 5$ with the formality of an *ὁμολογία ἐστὶν ἀπόδειξις*. Notwithstanding which I confess I am too long,, and that for want of more time: and yet perhaps had I staid longer, I might have shortened this discourse as to its present subject; but added much more by the way of improvement of it to other purposes. For tho I shall not rashly anticipate the *Evangel.*, before the triumph be legally decreed by the Philosophical Senate, at whose feet I humbly lay this performance: yet I perswade my self, that if what I have said concerning the Structure and motion of this Automaton, holds true; it may be made (upon the same principles and in a more capacious fabrick,) one of the Noblest Machines of Wheel work, that is yet known; so as to represent the entire Systeme of the Heavens, and that by a more natural imitation, and with fewer uncertainties in the motion, and with much less trouble in the keeping, then any movement that I (in this obscure place) have yet hard of. But it will be time enough to consider that, when I shall find how far the society approves of this: whose bare judgment shall be to me under all my present confidence, of farre greater moment then ten thousand reasons of my own. 'Tis indeed only a domestic Time-keeper (if that be any objection against it) intended for a steady regular motion at home, and not for wandring abroad: accommodated to the ready service of the industrious Student, and a fit companion for Books, among which it may possess a Shelf; and by it's Mystick Frontispiece teach the sober Spectator more true wisdom (namely, that of knowing how to Number and spend his daies;) then great massy volumes that contain nothing but Ink and Paper: I am very sorry, that I am not where I might have provided the Movement my selfe, and without the help of a Carrier, or the trouble of a journey, have presented it to you with my own hands instead of the Scheme and Notion; which would have been a conviction beyond all other demonstrations: But — and if in my present circumstances I have attempted my utmost to obey your commands; I hope it will be no less to your acceptance, then it has been to the satisfaction of

Your most affectionate Friend and Servant

Sibbertoft
May. 22. 84.

M. WHEELER.

*Experiments to be made relating to Land-Carriage,
propofed by the learned Sr. William Petty Kt.*

THe water carriage of goods round about the Globe of the Earth, is but about double to the price of Land Carriage from *Chester* to *London* of the like goods.

Land Carriage by Carts and Wagons is cheaper then on horses backs, and this cheaper then by men.

Wherefore carriage by Carts and Wagons ought well to understood and considered.

Land Carriage by draught, is by Wheele-barrows, Straddles, Carts of 2 wheels, Sleds, Wagons of 4 wheels, by Carrs on 2 high wheels, Drays on 2 small wheels, Irish Carrs of 2 very small wheels, The present work is to design experiments whereby to know the difference and advantages of all the said several Carriages upon several wayes and grounds. To which purpose it is offer'd that the following experiments be made, *viz.*

E X P E R I M E N T S.

1. The difference between what a Man or Horse can Carry, and what they can draw up at a Pulley.

2. The difference what a Man can endure to Carry one, two, three, fower, five, six hours, &c.

3. The difference of Speed that a Man can make under several burthens, within the same time.

4. Let the difference between the weight of a common *Irish* Carr, and the burthen which a horse can draw upon it be examin'd, as also the like difference between a Cart for 5 horses and its burthen, and between a Coach with a Coach-man with its burthen, and between the Pack saddle and of a Pack-horse and its burthen.

5. Let the difference between a Horses draught upon a small Carr, and a 5 Horses draught upon a great Cart and 4 wheel'd Wagon be examined.

6. Let the same differences of horses draught at several distances from the carriage, and upon wheels of several heights, be examined.

7. Let the just weight of wheels be determined, to make them of the same strength though of different diameters, and at what distance wheels of several heights should stand from each other.

8. What

8. What the difference is between Iron and Wooden Axell trees, and of the Grief and affriction made by them, with- in their boxes of their Naves.

9. What is the true reason of the dishing out of wheels.

10. What is the true proportion of Timber which ought to be in the Nave, Spokes, or Rim of any wheele, in order to lightness strength and uprightnes.

11. What is the difference between the high and low hanging of Coaches. the distance of the Standards, and of the difference between the hinder and the fore-wheels.

Other EXPERIMENTS.

Take a Parallelepepidon of wood, suppose 4 Inches square at the ends, and 8 Inches long with the weight thereof, and try as followeth *viz.*

1. How much weight less then that of it self, applyed to convenient pullyes, will draw the said Log over a smooth level Table, of an assigned length, in an assign'd time, and what weight will draw the same faster or slower, in any assigned proportion.

2. What difference there will be in the Affriction of the whole side of the said Log upon the plain Table, and mounting the same upon 2 small Keels of a quarter of an Inch thick.

3. What the difference between the last mentioned mounture, and setting the same upon 4 thick Segments of Circles, so as to touch the Table but at 4 points, in imitation of dragging wheels, and whether it be material that the said Segments should be of greater or lesser Circles.

4. What the difference between the said mounture upon 4 such Segments, or upon 4 wheels moving distinctly upon their Axell trees, as also between 2 wheels or one Segment like a Cart, or 1 wheele and 2 segments like a wheele-barrow.

5. What the difference in draught will be in the aforementioned draughts upon the various inclinations of the said Table, upwards and downwards, or upon the said Table covered with a blanket equally extended, or with a paste of Clay of a certain thickness.

6. What the difference between the tenderest motion upon wheels and the draught thorow water.

Christiani Hugonii Astroscopia compendiaria, Tubi optici molimine liberata. Or the description of an Aerial Telescope.

THE use of *Telescopes* being so necessary for *Astronomy* it hath been the endeavour of several lovers of that science to find out some more convenient and easier way, for the handling of the same. Then whereas all the perfection that hitherto hath been added to *Telescopes*, chiefly consisteth, in making them very long and the glasses of a bigger sphere, the same length and bigness thus increased, hath been stifled by a troublesome heaviness and disproportion to manage and direct them to the Stars. The Author hence, to take off the incumbrance, hath found out a devise in cutting or leaving out almost the whole tube, saving only a small part of it near the objective glass, and somewhat towards the Eye glass, ordering these two extremities in such a manner, that they may do the same service, as if the whole tube of one piece should be employed. To this purpose he explaineth himself by a scheme and clear description, how a mast must first be perpendicularly fixed into the ground, which for his own use he tells, was made of 50 foot long, serving for a *Telescope* of 70 foot then joyning two parallel rules all along this mast, he declareth how by this means the objective glass may be easily drawn up and downwards by the help of a string or cord, applied to an equilibrated weight, so that it be correspondent to the Eye glass. The circumstances whereof can be read in his printed paper, where also the full structure is to be seen. Only to come to the objection which the Author proposes himself, against the use of this curtailed *Telescope*. The *First*, is the fickleness in keeping alwayes the Eyeglass in the same posture: to remedy this, he describeth a two legged instrument to be put under the 2 arms, to hold them up the more steadily. *Secondly*, it seemeth to be a hard matter, to find out at night time in such a distance the objective glass or the Stars you look for, the cord alone not being able to direct the whole business: to help this inconvenience, he saith, one must make use of a lantern, which being in the same manner as commonly used for the projection of images, and dispersion of light, will give direction for the finding the objective glass, by inlightning the same for

to make a due agreement with that other glass. But as to observe the Moon, there needs nothing of this, when the glass easily may be discovered by the Moon light it self. *Thirdly*, it is very difficult to find (in such a length of a Tube of 100 or 200 foot) the true parallelism of the two glasses, the string being bended in the middle, and also not fit to give a true or strait direction. To this he answereth 1. that there is no need of such a geometrical perfection of parallelism, but that the same may have some latitude. 2. The string being of a small weight, and only a silk thred, which 50 foot long doth scarce amount to halfe a drachm, and yet able to hold 7 of weight, this bending of the string will cause only a small error, for to find how much the bending maketh it decline, if it is supposed to be a parabolical line in the curvature, the angle of deflection by the tangent will come to 24 minuts which in 150 foot distance produceth an error of one foot, that the Eye will be out of her true way of direction. But to remedy all this, he sheweth how by the help of the Lanterne such mistakes may be corrected. *Fourthly*, the constitution of the air, as being windie, or tempestuous will make a great hindrance, for the string or cord will be altered and drawn at one or the other side. To prevent this, there is no remedy: the common sort of Telescopes being subject to the same troubles. Yea sometimes, when the air is very quiet and the Sky clear, yet the stars much glittering, the Telescopes will not serve, also the vapours sometimes will stick to the glass. *Fifthly*, against the lantern before mentioned, one might object that at a distance of 200 and more foot, the light projected would be very weak, and not well to be discerned: but to make it brighter, a greater lantern must be got and a bigger wick put in, and other things ordered accordingly. *Sixthly*, if it should be too troublesome to, to fix such a long mast of a 100 and more foot, the Author sheweth how the composition of masts joyning one to another may be continued as far as necessity shall require. Yet for all that, he thinks, there will be no need to make these masts of such a vast height: for nobody will bring the Telescopes to such a perfection as to make appear any animal or creature in the Moon or Planets.

Because, first, there is such a difficulty in making the glasses, for the bigger they are, the more art is required in performing them. 2. There is scarce any piece of glass to be found fit for such a large business, being pestered with many faults. 3. The amplification of the things seen by Telescopes being regulated by the bigness of the aperture that the

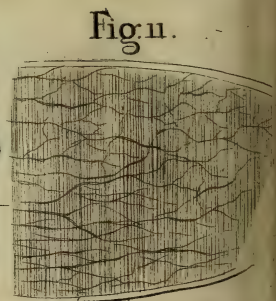
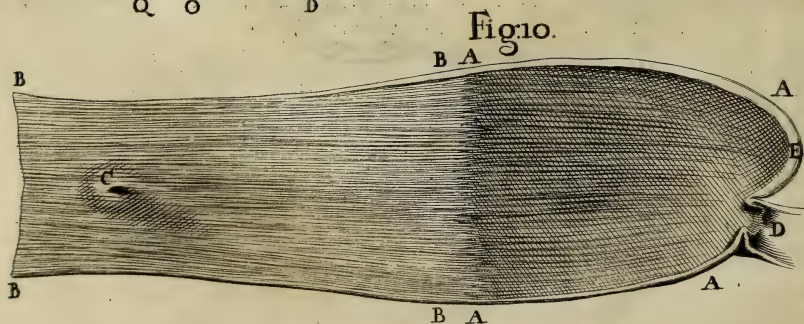
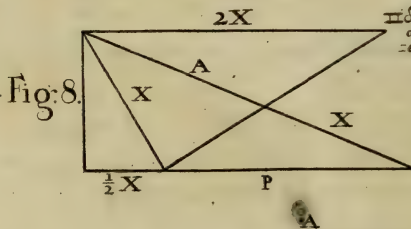
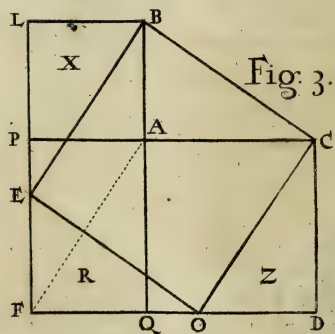
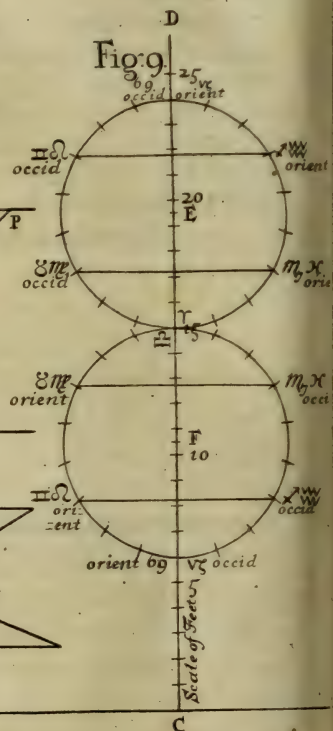
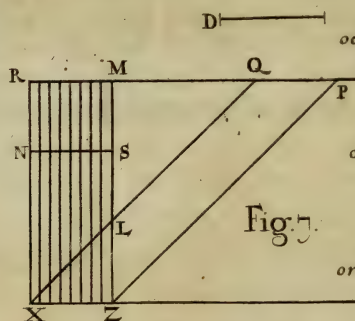
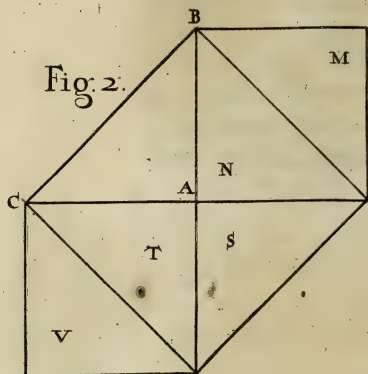
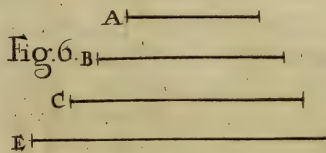
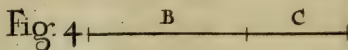
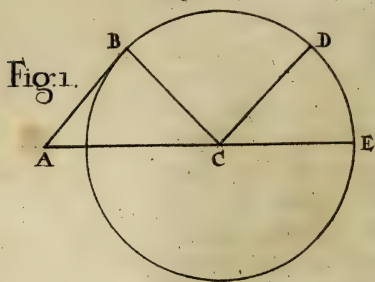
the objective glass will be in so much that the apertures are in a subduple reason to the lengths, it followeth, that a Telescope of 30 foot requiring an aperture of 3 inches, to another of 300 foot, that will bear no more than 9 inches and a half, is as 1 to 3, that is, will magnify but 3 times as much, but if it should make 10 times as big, it would require a length of 3000 foot, which he thinketh not to be practicable. 4th. There are still some irregularities in the nature of refractions, as is proved by Mr. *Newton's* experiments of colour, yet as far as is known, the said reason of the apertures to the lengths is thereby confirmed. Finally, for the better use of this Telescope, he giveth an admonition, that to observe the Satellites of Saturn found out by *Cassinus*, it is convenient to look through a narrow aperture, to exclude the light that cometh from the sides, and to restrain the apple of the Eye, which in the dark use to be very large and open.

O X F O R D,

Printed at the THEATER, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON. 1684.



Philosoph. Transact. Number 162.



Scale of Inches

M. Burg. sculp.

PHILOSOPHICAL

TRANSACTIONS.

Aug. 20 1684.

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A new and easy way of demonstrating some propositions in Euclid by the learned Mr. ----- Ash. a Member of the Philosophical Society of Dublin for promoting natural knowledge.

THe Preeminence of *Mathematical* knowledge, and the certainty of its way of reasoning are manifest from the few or no controversies between the *Professors* thereof (especially in pure unmixt *Mathematicks*;) and from the easy discovery of *paralogisms*. Some of the reasons of which certainty may be these: because *quantity*, the *object* about which it is conversant, is a sensible obvious thing, and consequently the *Ideas* we form thereof are clear and distinct, and daily represented to us in most familiar instances; because it makes use of terms which are proper, adequate, and unchangeable; its *axioms* and *postulata* also are very few and rational. It assigns such causes and generations of *Magnitudes* as are easily apprehended and readily admitted; it rejects all trifling in words and *Rhetorical schemes*, all conjectures, authorities, prejudices, and passion; Lastly so exquisite an order and method in *demonstrating* is observed, that no *proposition* is pretended to be proved, which does not plainly follow from what was before demonstrated, as is manifest in *Euclid's Elements*. Now as a farther instance of the evidence of *Mathematical Theoremes*, I believe it were not difficult to demonstrate any one of *Euclid's* independently from the rest, without precedent *Lemma's* or propositions; as an essay of which I will here subjoyn some of the most useful, and upon which the solution of most *problems*, especially *Algebraical* ones, do depend, and those also in the most various and different parts of *Geometry*, viz. concerning the properties of angles, circles, triangles, squares, proportionalls, and solids. The *Propositions* which I will endeavour to *demonstrate* thus independently

dently shall be these; the 32^d, and 47th, of the 1st. book, most of the 2^d, and 5th books, the 1st, and 16th of the 6th, with their *Corollaries*. In order to demonstrate the 32^d, I suppose it known what is meant by an angle, triangle, circle, external angle, parallels, and that the measure of an angle is the arch of a circle intercepted between its sides, that a right angle is measured by a quadrant, and 2 right angles by a semicircle. I say then (in *Fig. 1.*) that in the triangle ABC , the external angle BCE is equal to the 2 opposite internal ones ABC , BAC ; for let a circle be drawn, C being the Center, and BC the *radius*, and let CD be drawn parallel to AB , those 2 lines being always æquidistant will both have the same inclination to any 3^d line falling upon them, that is (by the definition of angle) they will make equal angles with it, for if any part of CD (for instance) did incline more to BC than did AB , upon that very account they would not be parallel, it follows therefore that the angles ABC , BCD are equal also $BAC = DCE$, because AE falls upon 2 parallels, but the external angle $BCE = BCD + DCE$ which were before proved to be equal to ABC , BAC (*Q. E. D.*) hence may be infer'd as a *corollary*, that the 3 angles of every triangle are equal to 2 right ones, for the angles $ACB + BCE$ are measured by a semicircle and therefore equal to 2 right angles, *Corollaries* also from hence are the 20th 22^d and 31st of the 3^d book which contain the properties of circles whose deduction from hence being most natural and obvious, I omit.

In order to demonstrate the 47th, I suppose the meaning of the terms made use of to be known; and that 2 angles or superficies are equal when one being put on the other, it neither exceeds, nor is exceeded: this being allowed, I say the sides about the right angle are either equal or unequal, if equal (as in *Fig. 2.*) let all the squares be described, the whole figure exceeds the square of the *Hypothenuse* BC by the 2 triangles M , U , and exceeds also the squares of the other 2 sides AB , AC . by the 2 trian-

gles ABC, and S; which excesses are equal, for M is equal to ABC, the 2 sides about the right angle, being 2 sides of a square, upon AB by supposition equal to AC, and the 3^d side equal to BC, therefore the whole triangles are equal. after the same manner S and U are proved to be equal, therefore the square of CB is equal to the square of the 2 other sides QED.

But if the sides be unequal (as in *Fig. 3d*) let the square be described, and the parallelogram LQ compleated, the whole Figure exceeds the square upon BC, by 3 triangles X, R, Z, and exceeds also the square LA, AD, by the triangle ABC, and the Parallelogram P. Q. which excesses I say are equal, for Z is equal to ABC, the side OC=BC, CD=AC, the angle D=A, and OCD=BCA, which is manifest by taking the common angle ACO out of the 2 right angles BCO, ACD, therefore by superimposition the whole triangles are equal. In like manner X is proved equal to ABC, also R; and the parallelogram PQ to be double of the triangle ABC; thus the excesses being proved equal, the remainders also will be equal, viz. the square of BC to the square of AB, AC (Q. E. D) manifest corollaries, from hence are the 35th and 36th of the 3^d book, also the 12th and 13th of 2^d. And here I shall observe that by this Method of proving the 47. 1. *Eucl.* tis manifest that that proposition may be demonstrated otherwise then *Euclide* has done it, and yet without the help of proportions, which *Peletarius* denied as possible.

The first 10 propositions of the 2^d book are evidently demonstrated, only by substituting *species* or letters instead of lines, and multiplying them according to the tenor of the proposition; thus to instance in one or two; in *Fig. 4* call the whole line A, and its parts B and C therefore $A=B+C$ and consequently $AA=BB+CC+2BC$ which is the very sense of the 4th of the 2^d book. Thus also (in *Fig. 5*) let a line be cut into equal parts F, F, and let another line S be added thereto, tis manifest that

$$4 FF + 4 SF + 2 SS = 2 FF + 2 FF + 2 SS + 4 SF,$$

which is the 10 proposition of the same book,

Almost the whole doctrine of *proportionals*, viz. permutation, inversion, conversion, composition, division of *Ratios*, and proportion *ex æquo*, and consequently the most useful propositions of the 5th book are clearly demonstrated by one definition, and that is of similar or like parts, which are said to be such as are after the same manner or equally contained in their wholes; thus (in Fig. 6) the Antecedents A and C are either equal to their consequents or greater, or less, if equal, the thing is manifest, if less, then (by the definition of *proportionals*) A and C are like parts of B and E, therefore what proportions the whole B and E have to one another, the same will A and C have, which is permutation, likewise $E : C :: B : A$ which is inversion; so also if from *proportionals* you take like parts, the remainders will be proportional, whence conversion and division are demonstrated; and if to proportionals you add like parts, the wholes will still be *proportional*, which is Composition &c. If the *antecedents* be greater then the *Consequents*, the *Consequents* will be like parts of them, and the demonstration exactly the same with the former.

The first of the 6th book is proved by considering the generations of *Parallelograms*, which are produced by drawing or multiplying the *perpendicular* upon the *basis*, that is, taking it so often as there can parts and divisions in the *base*: therefore (in Fig. 7) the same proportion that RX single, hath to NX single, the same hath RX multiplied by XZ, that is, repeated a certain number of times, to NX multiplied by XZ, that is, repeated the same number of times; which is as much as to say $RX : NX :: par : RZ : par : NZ$; now that this proportion also is true in oblique angled *parallelograms*, is proved, because they are equal to rectangled ones upon the same *basis* and between the same *Parallels*, as does thus independently appear (in Fig. 7) the triangles RQX and MPZ are equal, for $RX = MZ$, $QX = PZ$, $RM = QP$, therefore adding

adding to both $MQ, RQ=MP$, if therefore from these equal triangles you take what is common *viz.* MLQ , the remainders will be equal $RXL=QLZP$; to both which add XLZ , and the whole parallelograms will be equal, $RZ=QZ$ (Q. E. D.) that triangles also having a common *basis*, are in the proportion of their altitudes does hence follow, because they are the halves of *parallelograms* upon the same *basis*, this also is true, and the demonstration exactly the same in prisms, Pyramids, Cylinders, and cones, having the same *basis*.

To prove the 16th of the 6th I suppose (in Fig. 6.) the 4 lines A, B, C, E . to be proportional, that is, granting A and C to be the lesser terms, the same way that A is contained in B , so is C in E , and that D is the *denominator* of the *ratio*, 'twill follow then that B is made up of A , multiplied by D , and E of C multiplied by D , so that $AD=B$, and $CD=E$, draw therefore the extremes upon one another, that is A upon CD and the meanes, that is, C upon AD , the factors being the same, I say the products ACD and CAD are the same and consequently equal (Q. E. D.)

I know not whether it be worth the while to add somewhat (tho altogether impertinent to this present subject) concerning *Mons: Comier's probleme* which he lately proposed with ostentation enough to all *Mathematicians* to be solved, as if it contained something new, whereas tis no more then the old business of *doubling the Cube* a little disguised, this has been shewn by several, but by none (I think) after the *algebraical* way, or so briefly as follows in Fig. 8.

$$A : 2X :: X : 2 \frac{X}{A} q = P \quad \text{per 8. 6.}$$

$$Aq + 2AX \text{ --- } 2 \frac{Xc}{A} = 4 \frac{Xqq}{Aq} \quad \text{per 47. 1.}$$

$$Aqq + 2AcX \text{ --- } 2XcA = 4Xqq$$

$$Aqq + 2AcX = 4Xqq + 2XcA$$

$$A + 2X : 2A + 4X :: Xc : Ac : \quad \text{resolving which equation into an Analogy.}$$

that is, Xc (the *cube* upon X) is $\frac{1}{2}$ of Ac (the *cube* upon A)

An account of the course of the Tides at Tonqueen in a Letter from Mr. Francis Davenport July 15. 1678. with the Theory of them, at the Barr of Tonqueen, by the learned Edmund Halley Fellow of the Royal Society.

WHen the reported irregularity, of the *Ebbing* and *Flowing* of the *Sea* came first under my consideration at a distance, I was content to fancy that I had guessed aright in ascribing the occasion of it principally to the *Indraughts* and *outlets* of this *bay*, which as I Imagined might give (the different times of the year in respect of the *Monsoon's*, and the currents accordingly shifting with several other conceited coadjutant circumstances,) the most considerable share in the unusual course of the *Tides*, and that consequently it would scarce be possible to discover any constancy in them, if their regiment depended so much upon accidents and uncertainty's.

But during my continuance at *Batsha* I have observed such an order and constancy in the course of the *tides*, that notwithstanding I must needs confess it different from all that ever I observ'd in any other Port, yet not only from the coincidents of smilar alterations on peculiar dayes of some particular *Moone's*, in different *monsoons* in respect of their increase and decrease, as well as from their keeping equal pace with the *Moon's* rising and setting in this *Horizon*, in respect of the duration of their *influx* and *reflux*, but also from that which seems to render them most irregular, *viz.* the constant falling back of the *flood* nearest 13. hours on every second day of the waters age and increase, so that at the end of 15 dayes there is an inversion of their motion in respect of their begining to Flow and Ebb.

It is evident that they are regularly influenced though not reconcileable with a dependance on the *lunar* motion

tion so far as wholly to free the natural course from the interruption of some forreign intervening controulment.

Now for as much as it will be satisfactory enough for any mans benefit of the *tides* to know when the flood and ~~low~~ begins, and when there is the greatest and smallest influxes, without any nice discourse of the causes of their difference here, from those in other parts of the world, (a subject fitter for *Philosophers* then *Seamen*) I have here (to avoid overmuch tediousness) entred only the result of my unintermitted *observations*, of the *tides* dayly course, during my stay at *Batsha*, by which those *Commanders* who at this time of the year come before this *Barr*, may know when it will be most convenient to come over (supposing no *Pilate* goes off to bring them in) if they please to observe the following directions.

Directions concerning the choice of time in respect of
the Tides for coming over the Bar.

MY advice is, that upon the severall following dayes of the *Moons* age in every particular month of the yeare, no *English Commander* should upon any occasion whatsoever adventure over this *Bar* unless he have a *Pilot* from the Shoare, who undertakes to bring him in, or that he hath only charge of some small *Bark* or *Junke*, that draws no more then 8 or 9 foot water.

In the $\left. \begin{smallmatrix} 1 \\ 7 \end{smallmatrix} \right\}$ *Moones*, from the $\left\{ \begin{smallmatrix} 3 \\ 17 \end{smallmatrix} \right\}$ to the $\left. \begin{smallmatrix} 7 \\ 21 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively

In the $\left. \begin{smallmatrix} 2 \\ 8 \end{smallmatrix} \right\}$ *moones*, from the $\left\{ \begin{smallmatrix} 1 \\ 14 \end{smallmatrix} \right\}$ to the $\left. \begin{smallmatrix} 5 \\ 18 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively,

and from the 27 of the $\left. \begin{smallmatrix} 2 \\ 8 \end{smallmatrix} \right\}$ *moones* to the 1st of the $\left. \begin{smallmatrix} 3 \\ 9 \end{smallmatrix} \right\}$ *moons* Excl.

In the $\left. \begin{smallmatrix} 3 \\ 9 \end{smallmatrix} \right\}$ *moones*, from the $\left\{ \begin{smallmatrix} 11 \\ 25 \end{smallmatrix} \right.$ to the $\left. \begin{smallmatrix} 15 \\ 29 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively,

In the $\left. \begin{smallmatrix} 4 \\ 10 \end{smallmatrix} \right\}$ *moones* from the $\left\{ \begin{smallmatrix} 9 \\ 23 \end{smallmatrix} \right.$ to the $\left. \begin{smallmatrix} 13 \\ 27 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively,

In the $\left. \begin{smallmatrix} 5 \\ 11 \end{smallmatrix} \right\}$ *moones* from the $\left\{ \begin{smallmatrix} 7 \\ 21 \end{smallmatrix} \right.$ to the $\left. \begin{smallmatrix} 11 \\ 25 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively,

In the $\left. \begin{smallmatrix} 6 \\ 12 \end{smallmatrix} \right\}$ *moones* from the $\left\{ \begin{smallmatrix} 5 \\ 19 \end{smallmatrix} \right.$ to the $\left. \begin{smallmatrix} 9 \\ 23 \end{smallmatrix} \right\}$ dayes of the *moones* age exclusively.

And excepting on these six days above mention'd in every respective *moone*, he may safely adventure over the *Bar* any day provided allways that he mistake not the time of the *tide*, but come over at half *Flood* or better, though he may take notice, that the best *Tides* will be about six or seven dayes after the waters first begining to increase, and the first dayes of the waters increase are

In the	$\left. \begin{smallmatrix} 1 \\ 7 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 5 \\ 19 \end{smallmatrix} \right\}$	dayes.	} of the <i>Moones</i> age.
In the	$\left. \begin{smallmatrix} 2 \\ 8 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 3 \\ 16 \\ 29 \end{smallmatrix} \right\}$	dayes.	
In the	$\left. \begin{smallmatrix} 3 \\ 9 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 13 \\ 27 \end{smallmatrix} \right\}$	dayes.	
In the	$\left. \begin{smallmatrix} 4 \\ 10 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 11 \\ 25 \end{smallmatrix} \right\}$	dayes.	
In the	$\left. \begin{smallmatrix} 5 \\ 11 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 9 \\ 23 \end{smallmatrix} \right\}$	dayes.	
In the	$\left. \begin{smallmatrix} 6 \\ 12 \end{smallmatrix} \right\}$	<i>moones</i> on the	$\left. \begin{smallmatrix} 7 \\ 21 \end{smallmatrix} \right\}$	dayes.	

It is needless to take notice in what *hours* the waters increase begins, because the regular course of the *Tides* is not from thence commenced, in respect of the time of Flowing and Ebbing.

The *Bar* it selfe being about a Mile and half in Length, and no where except in its first entrance exceeding half a Mile in Breadth, is very even, but yet affords considerably differing *soundings* in the same Age and time of the *tides*, according to the season of the *Year*, and which seems to be somewhat strange, hath the highest *Tides* in the *Northerly Monsoon*, as I have been informed by those who are seemingly best able to give an account thereof: and I must needs say, that the tryal I now made on the *Bar* did accord with what I understood from several of the *Fishermen* and others as to this *Month*, which induced me to enter this Information, that coming over at half flood (except on the dayes aforementioned as Dangerous to come over in) there will be found according to the age of the *Tides*.

In the	3 } 4 } 5 }	<i>Moones</i> from 16 to 21 feet water.
In the	6 } 7 } 8 }	<i>Moones</i> from 19 to 24 feet
In the	9 } 10 } 11 }	<i>Moones</i> from 21 to 27 feet
In the	12 } 1 } 2 }	<i>Moones</i> from 14 to 22 feet.

Always the higher the *Flood* the Lower the *Ebb*, so that according to the strength of the *Tides* at Low water, the soundings are from 6 to 13 feet.

NB. This *Bar of Tunking* is about 110 degrees of *Longitude* to the East of *London*, and in *Latitude* 20. 50.

On the first and second dayes of the waters increase the *influxes* are very small and uncertain, but afterwards the *Tides* for 13 dayes are constant in their course, one flood and one ebb being compleated in 24 hours time, equally sharing the space of a *Lunar* circuition of the Earth between them, and every *flood* beginning nearest $\frac{3}{4}$ of an hour later then the *precedent flood*, and also considerably increasing in the height of the *tide* every day from the 3^d unto the 6th and 7th dayes of the waters age, on which two dayes the *flood* runs very high, but on the 8th day (which may be accounted the last of the *spring tides*, the waters begin gradually to decrease again, retaining the same orderly difference of time in each *tide*, untill the next following first day of the waters increase, when during two dayes unsetledness, there is a shifting of the *tides* in respect of the beginning of the *flood* and *ebb*, after which said shifting, a constancy in their inverted course, is again retained in the above mentioned order for 13 dayes following, as for *Example*.

On the 25 and 26 dayes of the 4th moone (4th and 5th of June 1678) in the latter end of *Aries*) being the first dayes of the waters increase, the *influxes* were very small (there happening on the 26th a falling back of the *tides* about 13 hours) but from the 27th (June 6. 78.) which was the 3^d day of the waters increase after the last quarter; unto the 9th day of the 5th moones age, (June 18. 1678) in ≈ 20 ,) I noted a very constant course in the *tides*, every *flood* begining with the rising of the *moone* and ending at its setting, the following *ebb* in like manner continuing during the time of the *moones* absence from this *hemisphere*. But on the said 9th day of the 5th moones age (June 18. 1678) being the first day of the waters increase, their motion was scarcely perceptible; on the 10th day there was another falling back of the *tides* nearest 13 hours, and on the 11th day, (which was the 3^d day of the waters increase, after the first quarter of the *moones* age) the *flood* having (as I said) shifted the pre-

ceding day, took its turne to begin at the *moones* setting and end at its rising, and accordingly the tides successively following assumed & kept a constant regularity the *tides* being at highest the 16th of the *moone*, (1678. June 24. (in middle of ∞) which was the seventh of the waters age, until the 23^d of the said *moones* age (July 1. 1678.) on which (being the first day of the waters increase) the influx was again scarcely discernable for its smallness.

On the 24th day the *tides* fall back (as I had found it twice before to have done on the same dayes of the waters age,) nearest 13 hours by which meanes the *flood* on the 25th day (which was the 3^d day of the waters increase after the last quarter of the *moone*) now again commenced with the rising *moone*, whereby it hath fallen out allwayes to be high water between *noone* and the following *midnight* every day during my stay here. ((last quarter 22 dayes, (first quarter 8 dayes.)

So that it may pass into a *Corollary* viz. In the 4th 5th and 6th changes of the *moone* from the 3^d day of the waters age after the last quarter, to the 3^d day of the waters age after the first quarter of the following *moone*, the water begins to *flow* when the *moone* riseth, and to *ebb* again when it setteth in the *Horizon*, and the contrary to the 3^d day of *their* age after the last quarter, excluding allwayes their motion on the 2 first dayes of the waters increase, because of its smallness and uncertainty.

I am inform'd by the *inhabitants* hereabouts, that this may hold for a *rule* from the 2^d to the end of the 7th *moone* and that the *converse* thereof holds true in the other six months of the year, viz. from the 8th to the end of the first *moone*, according to which the *tides* will fall out to be at the highest in the evening for 6 months successively, and the other half year in the *morning*, that is to say between *midnight* and the following *moones*, and though I cannot aver the truth of it, yet I find that the

tide

tide last year in the 11th *moone*, which occasionally upon the Ship *Eagles* departure hence, I took some notice of, and entred in the close of my *Sea journal*, did fall out not disagreeing with what they affirme, and I am yet the rather induc'd to believe that in every *annual revolution* there may be such a constancy in this different motion of the *tide* appropriated to each moiety of the year, because, that dureing my dayes stay at *Batsha*; I have found the *predictions* of the *natives* confirmed by my owne *observations* of the *tides* falling out to be high water alwayes between *noone* and the succeeding *midnight* occasioned by the aforesaid falling back at the end of 15 dayes; so that on every 3d day of the waters increase, the *flood* begins at the hour whereon the day before it ended.

To prevent mistakes in the accompt of the *moones*, though the difference of *meridians* between this place and *London*, together with the different beginning of their *natural day* in their accompts here, from that of ours, and some imperfections from which their *Astronomical observations* are not free, may occasion a disagreement between our accompt and theirs, of the *moones* age, yet it will never be so considerable as to occasion any sensible, at least dangerous *error* in the above mentioned reckoning of the *tides*, provided the number of the moneth be not mistaken.

Wherefore it may be sufficient to informe those who use this *Port*, that the first change of the *moone* after the 15th day of *January* old stile, is reckoned for the begining of the year, and that *moone* being accompted the first, the rest follow in order until the expiration of the 12th which compleats their year, alwayes except only in their *leap years*, and then they have 13 *moones*, takeing in one extraordinary to make up the deficiency of the *moones* *epact* in their accompt, in which year the first day of their new yeares *moone* falls out before the said 15th of *January*, as it did this year upon the 12th being *leap yeare* with them,

them, so that they reckoned two months for one this
 yeare, (that is to say the 2^d and 3^d *moones* after their
new years day) they called 2^d *moones*, for otherwayes this
 present *moone* which changed in *July* (the 8th) would have
 been the 7th, whereas now they count it but the 6th
moone, and accordingly do the *tides* fall out, but this *leap*
yeare being now past the first *moone* in the yeare must be
 reckoned to begin on the change next following the 15th
 of *January*, and all the other changes counted successive-
 ly as before said until the intervention of another *leap*
yeare.

Observations

*A Theory of the Tides at the Bar of Tunking by the
Learned Mr. Edm. Halley, Fellow of the Royal So-
ciety.*

THE effect of the *Moon* upon the *waters*, in the production of the *tides* in this port of *Tunking*, is the more wonderful and surprizing, in that it seemes different in all its circumstances from the *general rule*, whereby the motion of the *Sea* is regulated, in all other parts of the world I have yet heard of. For first, each *flux* is of about 12 hours duration, and its correspondent *reflux*, as long, so that there is but one *high water* in 24 hours. Then there are in each month, two *intermissions* of the *Tides*, about 14 days asunder when there is no sensible *flood* or rising of the waters to be observed; but the *Sea* is in a manner stagnant. Thirdly, that the increase of the Water has its 14 days *period*, between the aforesaid *intermissions*; and at 7 days end, makes the highest *tides*, from which time the water again gradually abates, and the *flood* is weaker till it comes to a stagnation, both *increase* and *decrease* observing the same *rule* in being exceeding *slow* in their begining and end, and *swift* in the middle. Lastly, (and which is most odd) the *rising Moon* in the one half of each *month* makes high water, and the *setting moone* in the other half. These particulars considered together with the *Tables* shewing the days of the waters stagnation, in each moneth, gave me a light into the secret of this strange appearance, so as to be able to bring the hitherto unaccountable irregularity of these *Tides* to a certain rule. And first it appears by the latter of the two *Tables*, that the *intermissions* of the *Tides* happen nearly upon those days, that the *moon* enters the signs of *Aries* and *Libra*; or passes the *Equinoctial*; which divides the *Moons* course nearly into two equal parts, as well as the *Suns*, and from hence it follows that the *Tropical*

pical Moones in ☾ and ♀, are these which occasion the greatest flux and reflux; and for the rule of the change of the time of *high Water*, which Mr. *Davenport* calls a falling back of the *Tides*, the example he hath given us, lets us know, that the ☾ in *Northern* signs, brings in the flood whilst she is above the *Horizon*, so as to make *high water* at her setting, and on the contrary that whilst shee is in *Southern* signs, it flows all the time the *moon* is below the *Horizon*, and so make *high water* at her rising. But it is to be observed that though the *Moon* pass swiftly, from *South* to *North* when she is in or near ♊, and from *North* to *South* when in or near ♎; yet the motion of the *Sea* which is the cause of this *tide*, is scarce discernable for 3 or 4 days, when the *Moon* passes the said *Equinoctial* points; whence it appears that though the *declination* of ☾, or her distance from the *Equinoctial*, be that whereby these *Tides* are regulated, yet the increase and decrease of the *water* is by no means proportionate to that of the *declination* of *Luna*, that changing swiftly, where the increase of the *water* is observed to be most slow. It seems therefore, and I propose it as a probable conjecture, that the *increase* of the *waters* should be allways proportionate to the *Versed signs* of the doubled distances of the *Moon* from the *Equinoctial* points; Upon which *Hypothesis Figure 9.* will give an elegant *Synopsis* of the whole matter. Let AB be the bottom of the *Bar of Tunking*; CD a perpendicular thereto, whereon to measure the several depths of the *water*; CV, C $\square$ the mean depth, which is that whereat the *water* is stagnant upon the *moons* being upon the *Equinoctial* points, being commonly about 15 feet: C☾ *occid*, the high water mark when the *Moon* is in ☾ or ♀ being about 24 foot. C♀ *occid* the height of the Low water mark when the *Moon* is in ☾ or ♀, being about 6 foot; so that the greatest rise of the *Water* on the *Tropical Moons* will be about 18 foot; then dividing ♊ ☾ and ♎ ♀ into two equal parts in EF, on those two points, as *Centers*, describe the 2 *Circles*, each of whose *Radii*, are four

four feet and a half, which being kept between the *Compasses*, naturally divide the said *Circles* in the points $\delta \Pi \odot \delta$ &c. through the which points if you draw lines parallel to the base A B they shall cut the perpendicular C D, in the heights of the *high* and *Low water* marks, which will be at the entrance of the *Moon* into the said *signs*. So the greatest depth of the *high water*, when the *Moon* enters δ, π, δ, π , is but $17 \frac{1}{4}$ feet, and the least at *Low water* $12 \frac{3}{4}$ feet: but when she Enters $\Pi, \delta, +, \infty$, the *high-water* depth is $21 \frac{3}{4}$ feet, the *Low-water* but $8 \frac{1}{4}$ feet; as appears by the *figure*. And this Hypothesis not only agrees with all that Mr. *Davenport* hath observed himself, or collected from the *Natives*, but hath been found to hold true since in the year 1682 by the Ingenious Capt. *Knox*, in his Voiage to this port; so that there is no room to doubt of the truth thereof. By this method may the time and height of the *Tides* be with sufficient certainty computed, but to philosophize thereon, and to attempt to assign a reason, why the *Moon* should in so particular a manner influence the *waters* in this one place, is a task too hard for my undertaking, especially when I consider how little we have been able to establish a Genuine and satisfactory *Theory* of the *Tides*, found upon our own *Coasts*, of which we have had so long Experience. It would be however a very acceptable thing if some curious *Navigators* would inform us, what *tides* or *Currents* are found at *Macao*, *Quemoy*, and other places on the *Coast* of *China* and on *Formosa*; it being most probable that this flood cometh out of the North East, alongst the *Coast* of *China*, for that the Northerly *Moonsoon* is found to occasion the highest *spring-tides*. There is yet another thing well worth Inquiry, that seeing that this motion of the *Sea* is more or less as the *Moon* is farther from or nearer to the *Equinoctiall*, it is not unlikely, that some years may have much higher *Spring-tides* than others, according to the Various Obliquity of the *Moons orbite* to the *Equinoctiall*, for when the ascending *Node* is in $\vee$, (as it was anno 1671 and will be anno 1690)

the *Moon* in ☾ and ♄ deviates from the *Equator* full $28\frac{1}{2}$ degrees; and but $18\frac{1}{2}$ degrees, when the same *Node* is in *Libra*, as it was anno 1680; and I recommend as a very usefull *Quærie*, for such as for the future shall use this *Port*, to examine whether the *Tides* are not in some years more *Vigorous* than in others, and particularly in the years but now mentioned; as likewise if there have been any *Inundations* occasioned by an extraordinary *flux* of the *Sea*, in what years the said *Inundations* have happened.

Defectus exigui Lunaræ Observationes, Grenovici habitæ Junii 16. 1684 p. m. n. seq. à Johanne Flamsteedio. Math. Reg.

Difficillima fuerit parvæ hujus *Eclipsis* observatio, propter obliquam *lunæ* in umbram terræ Incidentiam, Umbræque ipsius tenuitatem, per quam limbum *Lunæ*, media etiam *Eclipsi*, satis distincte cernere potuimus. Partes *diametri* tunc ab umbra vera deficientes, propter confusos ejus terminos accurate definire non licuit. Distantiam ergo cœpi inter cuspides male definitos, circa medium defectus, è qua dictæ partes facile deduci possint, & cum erroris minore periculo Cœlum habuimus toto tempore *Eclipsis* satis serenum. Observata sic se habent.

Tempora per horolog. oscillator.			Tempora vera ab obs. Correc.			1684 Junii 16.		
<i>h</i>	<i>'</i>	<i>"</i>	<i>h</i>	<i>'</i>	<i>"</i>			
13	40	40	13	31	08	<i>Eclipsis</i> minæ		"
14	04	30		54	58	<i>Lunæ</i> diameter tubo ped 16 e	31	57
						rat 6405		
6	40			57	08	rep. 6430	32	04 *
12	00		14	02	28	Penumbra densa forsan initium,		
16	00			6	28	Umbra limbum supra finam temeraverat,		"
18	00			8	28	Umbra certe intra discum		
21	36			12	04	Chorda peripheriæ obscura	8	20
						tæ 1670		
26	00			16	28	rep. 2010	10	01
36	00			26	28	iter. 2290	11	25
42	00			32	28	Decrevit <i>Eclipsis</i> sensibilibiter		

<i>b</i>	<i>z</i>	<i>b</i>	<i>z</i>	<i>'</i>	<i>"</i>
43	00	33	28	Inter Cuspides obscur.	iter-1895 9 27
50	00	40	28	Finis sed dubius mihi	
54	00	44	28	Finita certe, ministro Fabro	
				Consentiente	
57	00	47	28	Penumbra densa	
15 11	00	15 01	28	Etiam adhuc.	
20	00	30	28	Limbus <i>Austrinus</i> haud adhuc	
				limbi <i>borei</i> claritudinem re-	
				cuperaverat. Sed lux ejus he-	
				betior quam in limbo <i>boreo</i> , ut	
				in prima observatione appa-	
				ruit.	

Solaris defectus Observationes Grenovici habitæ Anno
 1684. Julii 2. p. m. ab J. F. Grc.

AD hujus *Eclipsis* observationem, præter tubum pedum 16. assuetum, *scenam* etiam sub obscurato conclavi cum præparassem, quo diameter circuli solis speciem in alba tabella adæquantis, $5\frac{1}{2}$ digitos pedis *Anglicani* lati, sedecim circulis concentricis æquidistantibus in 32 partes æquales distinguebatur, quot fere minutorum *Solis* nunc diameter: Cælum mane præcedente nubibus obductum exitit. Hisce tamen circa horam secundam p. m. dissipatis, *Sol* clarus & ab *Eclipsi* immunis explenduit hor. 2h 04. Deinde ab iisdem rursus exceptus latuit usque 2h 12 $\frac{2}{3}$, quando ab iis iterum prodeuntis plus quam media pars unius minuti supra *scenam* in limbo deficere videbatur. Exinde cælum ad finem usque satis habuimus propitium: sed phasium crescentium parum incommodæ fuere supra *scenam* oblationes, propter nimiam solis altitudinem, & per tubum. Quoniam ventus ab *Africo* flans vehementior, stabilem illum detineri non permisit; pauciores quamobrem utrisque ante medium factæ adnotationes. Obscuratio maxima fuit min. 19 $\frac{1}{2}$ supra *scenam*, cujus ope observatis etiam tubo & micrometro factæ animadversiones satis consentiunt. Desiit *Eclipsis* hora 4h 27' 37" accurate, cum mihi per tubum, tum ministro supra *scenam* observanti; vix plus uno temporis scrupulo horatio serius quam edita à me antea ejusdem promiserat Constructio: Reliqua sic se habuere observata.

Temp. per horolog. oscillator.	Temp. inde ab observat. correcta.	1684. Julii 2. p. m. ☉ deficiente.	partes supra scen. defic.	partes liberæ micro- metro.
b ' "	b ' "			
2 12 30	2 03 45	<i>Sol</i> integer. tunc nubes.		
21 02	12 17	☉ def. per exiguum ima ora.		
21 25	12 40	Partes obscuratæ supra <i>scenam</i>	0 $\frac{1}{2}$	
32 20	23 35		4	
46 40	37 55			22 19
				51 37

	51	37	42	52			11		
3	05	23	56	38			15		
	9	05	3	00	20	Centrum	16		
	10	04	1	19				15	07
	11	47	3	02				14	36
3	12	15	3	03	30		17		
	13	23	4	38		Cornua horizontalia			
	17	43	8	58			18		
	21	48	13	03				12	30
	23	00	14	15			19		
	25	40	16	55				12	11
	29	51	20	06			19 $\frac{1}{2}$		
	33	54	25	09			19 $\frac{1}{2}$		
	40	08	31	23			19		
	43	16	34	31			18 $\frac{1}{2}$		
	45	35	36	50			18		
	49	15	40	30		Cuspis inferior ad Nadir ☉s			
	50	02	41	17			17		
	54	20	45	35		Centrum	16		
	56	45	48	00			15		
4	02	58	54	13			13		
	6	00	57	15			12		
	8	45	4	00	00		11		
	16	32	7	47			8		
	17	44	9	00		Cuspides verticales dist. 84.gr.			
	24	08	15	23		Inter Cuspides		17	32
	24	20	15	35			5		
	27	14	18	29		Inter Cuspides		15	35
	29	36	20	51			2 $\frac{1}{2}$		
	30	32	21	47		Inter Cuspides		12	22
	33	06	24	21			1 *		
	36	22	27	37		Finis accurate.			

Deinde ad errorem horologii investigandum, distantia
observata à vertice.

				hor. inde supp.	Error. hor.	
				" b "	" "	" "
4	43	38	60	11	00	4 34 56 --8 42
	45	48	60	31	20	4 37 07 --8 41
	46	56	60	41	50	4 38 15 --8 43
	49	03	61	01	40	4 40 23 --8 41

limbi ☉s
inferioris

A calculation of the same Eclips, juxta Tabulas Philolaicas with the observations of the learned Bullialdus and Cassini.

	H	'	"		°	'	"	
Initium	2	14	56.	Alt: ☉	52	10		Primum punctum Eclipsos distat ab infimo termino diametri ☉ ad horizon-tem perpendi- culariter partib. 17 ad Occasum qua- lium.
Max: obs:	3	28	28.	Digiti deficientes				
Visa ☉	3	30	43.	VIII	20'	45"		
Finis	4	37	23.	Altit.	28	35'		

Peripheria Disci ☉ est 360

Ultimum distat ab eodem infimo ejus Diametri partibus iisdem 116.

Observavit Clar. Bullialdus.

Alt. ☉ gr. 50 Initium elapsum erat sole nubibus recto, & digitus circiter deficiebat.

Alt ☉ 41 15' Paullo amplius quam digiti VII. attigit digitos VIII.

Alt ☉ 29 30' finis

Puncta initii & finis satis bene convenire Tabularum Calculo observata sunt.

Observavit Cl. Cassini in Observatorio Regio.

Initium $\begin{matrix} b \\ 2 \end{matrix}$ 25 30 deductum ex Phasibus sequentibus.

Finis 4 43 23.

Maximus defectus Digitorum 8.

*A Discourse concerning Digestion in a Letter to the
Publisher from Mr. Charles Leigh of Brasen-Nose
Colledge Oxford.*

S I R,

Should I reckon up here the many controverted *hypotheses* of *Anatomists* concerning this *subject*, & set up a new one of my own; it might perhaps seem a piece of fond presumption: I shall not therefore be so vainly *opinionative* as to think that I have here fully explained the nature of *Chylification*, but shall onely give you an account of an *Artificiall* digester which I hope may something illustrate the *naturall* one. It has been observ'd by *Helmont*, *Mæbius*, *Tachenius*, and the Honourable Mr. *Boyle*, that meats by being kept in an *acid* liquor, would looke extremely *white*. But I do not find that by the help of a *salt* that is meerly an *acid*, there can be any *chyle* prepared from any meats. *Wedelius* is of opinion that *Chyle* is nothing but a mixture of oil and *Serum*. *Tilingius* affirms that tis made by a *nitrous* Salt. Dr. *Harvey* by trituration. Dr. *Willis* by an *acid* and *Sulphur*. *Diemerbrook* and *Sylvius* by the *Saliva*. Dr. *Mayow* by a *Nitroaerial* principle. *Galen* and *Aristotle* by *heat*. Others by a *ferment* spewed from the *glands* in the bottom of the *Stomach*. Others by the *relicts* of the meat grown *sour*. So many different *opinions* I shall neither pretend to reconcile or decide. And shall therefore onely lay down the *Phænomena* which this liquor afforded, and from them draw inferences as probable conjectures. But shall in the first place premise a description of this *digesting liquor*, and see how far it may probably parallel the *naturall ferment* in the *Stomach*. The taste of it is like meat vomited out of a full stomach, something *Sour*, but will not ferment with an *Alkali*.

It is prepared from spirit of *Sulphur*, spirit of *Hartsborn*,
the

the *Chyle* of a *Dog* and the *Saliva*: it is pellucid and without any smell: the *Salt* that it shoots into is *cubical*. Upon *veal* it afforded these *Phænomena*. Into a dram of this liquor I put a piece of *veal* about the bigness of a *Nut*, & set it upon a digesting furnace. In two hours time there came from the meat a liquor that had the colour and taste of *Chyle*, and the meat afterwards was lighter, dry, and insipid. And it afforded the same *Phænomena* also in beef, mutton, or any other meat that I could meet with. And here it is to be noted, that tho it has been affirm'd by some that the same thing may be done by *acid* liquors only, yet since by all the tryals I have made upon'em, I have not yet observ'd the like *Phænomena*, I hope my *Scepticism* in this case may be pardonable. If therefore we now consider that by the help of this *menstruum* there came from the before mentioned meats, a liquor which had the colour and taste of *Chyle*, and if we further consider that the taste of this *menstruum* is not distinguishable from the taste which is perceivable in meats vomited out of a full stomach; I hope I may without being thought fond of an *Hypothesis*, conjecture that by some such *menstruum* the meat is *digested* in the *stomach*. But here I would not be thought to affirm that by a liquid *menstruum* alone the meats are digested, but that there are likewise required these further requisits, in some, or in most creatures. First, that the *stomach* receive a gentle heat from the *liver*. 'Tis therefore for this reason said by the Learned *Glisson*, *Calor hepatis in hepate est actio, & ventriculo est usus*.

Secondly, that the *stomach* have a *naturall* situation. For, says *Riolanus*, *Interdum ventriculus propendit usque ad umbilicum, ut observatum in cadaveribus, quod vitæ coctioni multum incommodat*. And *Vesalius* in his *Anatomy* Lib. 4. gives us this example. *Observavi omentum in scrotum devolutum & auctum ventriculum ex sede sua distraxisse, adeo ut munus ejus deficeret*. Thirdly, it is assisted by the *omentum*. This may be argued from those creatures which

O

have

have no caul, helping *concoction* by doubling their hinder legs, and resting their bellies upon them, as hares and conies. A second instance may be brought from *Valentinus*. *Andreas Molenbrochius* in *Miscellaneis curiosis Ann.* 1670. *Militaris quidam vir dum viveret nil nisi ventriculum accusabat, quod nullum cibum appeteret coqueretque, cui ad confortandum ventriculum multa adhibita fuere, sed omnia incassum: dissecto cadavere, omentum plane putrefactum est, ventriculo reliquisque visceribus salvis; ex quo colligitur, omentum ad ventriculi coctionem non parum facere.* Fourthly, 'tis necessary that the *stomach* have a *Tunica villosa*: 1. Because that by that it is enabled to divide the meat into parcells, which undoubtedly must much facilitate the operation of the *natural ferment*: As we see all *menstruums* will sooner dissolve *metalls* when they are filed into parcells, than when they continue in the lump. 2. If it had not a *Tunica villosa*, the *Tunica carnosa* would be apt to be too much distended by our meat and drink, which would necessarily weaken the tonical motion of the *stomach*, and consequently therefore its *digestion*.

Fifthly, that there be a right *digestion*, it's necessary that there be windings of the *Intestines*; for if it were not for these, the *digested meat* would move too fast from the *stomach*, and so torment us with perpetuall hunger. Which assertion I think may sufficiently be confirm'd by these two instances. The first is from *Cabrollius* observation the 10th, and *Riolanus Anthropol.* lib. 2. cap.

Firminus Chaudonius voracitate erat Erysictonæ, cui causam præbuit, quod nec stomachi nec intestinorum figuram ullam habebat proportionatam, unicum a Pylori loco ad Anum Intestinum erat sine ullo anfractu, cumque aliorum Intestina quatuordecim æquant ulnas, hujus vix ad quatuor spithamas accedebant in formam literæ S. The 2. Instance is taken from a creature in *Lithuania* and *Muscovy* that generally feeds upon it's prey, till it's belly be swell'd like a bladder, then conveys it self to some strait place, and so violently forces

forces the meat out of its *stomach* and *intestines*, and then immediately returns to its prey with as craving an appetite as before: which continuall and insatiable hunger is judged to proceed from the *straitness* of its *Intestines*; for, as the Learned *Pavius* observ'd in its dissection, its guts had no circumvolutions or windings. From these therefore 'tis plain that besides a fermenting liquor in the stomach other externall means concurr to digestion.

I shall therefore in the last place inquire what may probably be the *Ingredients* of the *natural ferment*, & so conclude. The *Ingredients* of the *natural ferment* I take to be these. The *saliva*, the *succus* of the *Glands* of the *stomach*, and a *nitro-aereal spirit* of the *nerves*. That the *Saliva* is an ingredient, may seem probable from these reasons. 1. Because that by the help of this, *meats* tho impregnated with different principles, may be made to mix with a *menstruum*; for, as the Learned *Steno* has it pag. the 27th, *de glandulis oris: Saliva vero omnia ferre valet; sive intra corpus sive extra corpus examinaveris, nihil invenies quod illa respuet, nihil cui sine pugna non associetur.* 2. Since the *Saliva* is impregnated with a volatile salt, it is probable that that too may help digestion. The second ingredient I take to be a *liquor* that is separated by the *glands* in the bottom of the *stomach*. And this I shall evince by the Authority of the famous *Willis*, and *Sylvius De le Boe*. And first from Dr. *Willis* in his *Pharmaceutice Rationalis*, pag. 6. *Tunica hæc villosa in postica sive convexa ejus superficie, quæ tunicæ nerveæ coheret, glandulis annulatis numerosissimis ubique confita est, quæ proculdubio vasorum in tunica nervea debiscentium ora contegunt: ac (uti videtur) humorem illis destinatum aut ab eis depositum, immediatius excipiunt ac percolant.* *Sylvius* pag 881. gives us this account of it: *hoc chylificans fermentum in recens natorum vitulorum ventriculis reperitur crassiusculum, diciturque coagulum: sensim autem minuitur, ac in adultis, glutinis instar, offenditur liquidiusculum inter ventriculi rugas hærens.* By these there-

fore it seems probable, that the *glands* in the *tunica villosa* separate a *fermenting liquor*, and 'tis further observ'd that those creatures which have the most of these *glands*, are the most voracious. Lastly that the *nitro-aerial* spirits of the *nerves* are an ingredient of the *stomachical ferment*, seems reasonable from the Arguments of Dr. Mayow, pag. 55. He argues thus: *Jam vero cum spiritus animales e particulis nitro-aereis constant, haud difficile erit intellectu quomodo effectus praedicti ab iisdem in ventriculo perficiuntur. Quanquam enim spiritus Nitro-aereus acidus non est, ab eodem tamen ferrum corroditur, vitriola perficiuntur, salia fixa ad fluorem perducuntur, rerumque compages tanquam ab universali menstruo solvuntur.* These therefore (Sir) are my thoughts concerning digestion; but here is nothing in these *Dogmatically* asserted. If therefore any *Hypothesis* here may be found erroneous, upon better grounds I shall readily lay it down.

I am, SIR,

Your very humble Servant,

C. L.

An abstract of a Journal of the Philosophical Society of Oxford, being an account of some Experiments relating to Digestion read before that Society, and of a large bed of Glands observ'd in the Stomach of a Jack.

Aug. 19th 1684.

THe Society being met, the following Experiments were tried, by Mr. *Musgrave*.

Part of a mucous substance, taken out of the Stomach of a *Jack*, near the *Pylorus*, and mixt with solution of sublimate, became much *whiter* than it was before.

Another part of it, mixt with Syrup of Violets, turned *Green*.

The same person has observ'd like effects, by mixing a Liquor, found in the stomach of a *Hedghog*, with Syrup of Violets, and with solution of sublimate.

These experiments are urg'd as an argument against the existence of an *Acid Ferment* in the stomach: It seems probable, that the great work of *Digestion* proceeds from a *Volatile Alkali*.

He also took notice of a large *Bed of Glands*, making about $\frac{3}{4}$ ths of the inside of the stomach, and seated near the *Pylorus* of a *Jack*: the whole Bed appears of a brownish red colour, and is divided into several *Ridges*, which run parallel to one another and the same way with the stomach: for the better contraction of that part, especially when empty; (at which time these Glands, being fixt to the inmost coat, are, together with it, drawn up into wrinlkes:) that edge of this Bed of Glands, which is nearest the head of the fish, is dented; the Ridges breaking

ing off on a sudden ; but at the other end, a little on this side the *Pylorus*, they diminish almost insensibly.

By these Glands, he supposes, at least a considerable share of the *Menstruum* (the great efficacy of which, makes this Fish, a fit subject to illustrate the nature of *Digestion*) is separated from the *Blood*; for Blood-vessels may be seen, in great numbers, on the other side of the Glands, and inner Tunic, by separating it, and them, from the middle, and muscucose Tunic: and, as a farther argument of this use of these Glands, he has observ'd that that part of the stomach, where they are, is generally moister, then the other part, near the mouth ; and that, in dissecting Jacks whose stomachs have been fill'd with some large fish of the *pinnaceous* kind (which must enter with the head foremost) the head, and foremost parts of the devoured fish, have, as far as the Glands reach, been, either actually dissolved, or fairly turning, into a mucilage ; whereas, at the same time, the other, and less bony part, of the included fish, being not yet come within the power of the *Menstruum*, has still retain'd its forme and Consistence.

Fig. 10: represents the inside of the stomach of a *Jack*, which was one foot, and 8 inches long; the stomach itself about 8 inches, and a half.

AAAA Shews the *Bed of Glands*.

BBBB That part of the inner Tunic, which reaches from the *Bed of Glands* to the mouth of the fish: it appears much whiter then the *Glands*; the *Fibres* run the same way with the stomach.

C The entrance into the passage which leads to the *Bladder of Air*.

D The *Pylorus*.

E The

E The hollow of the stomach continued beyond the *Pylorus*.

Fig. 11. Represents the other side of the *Bed of Glands*, separated, together with the inner, from the middle, *Tunic*; and great numbers of *Capillary Vessels*, belonging to the *Glands*, but broken off in separation.

Experiments and Considerations about the *POROSITY* of *BODIES*, in two Essays by the Honourable Robert Boyle Esq; Fellow of the Royal Society Lond. in 8° 1684.

THe Honourable Author, continuing his endeavours to establish a solid and rational Philosophy, does in this book discourse of the small *Pores* of *Bodies*, a subject of very great importance towards an intelligible account of Occult Qualities.

The Book consisting of two Essays, the former of them treats of the *Porosity* of *Animal Bodies*, and shews that the parts of Animals (especially whilst these are alive) are furnished with numerous pores; which is deduced from the Frame or Constitution, of the stable parts of the bodies of Animals;

From the nature of nutrition in Animals; for that requires, that the body abound with *Pores*, into which congruous particles may be admitted, for the natural increase of the part.

From the great plenty of matter daily carried off by sweat, and insensible transpiration; by which, and several other arguments, he proves the porosity of the *Skin*; he proves the same thing in the membranes, that invest the internal parts; in the urinary bladders of dead animals; and in the Films that line the shells of Eggs.

From the entrance of *Effluvia* into Animals; evident from the operation of some plaisters, and vegetable ointments; from the effects of *Pericarpia*, or wrist-bands; and from Cantharides used in blistering plaisters; and effecting the urinary passages even before the skin of the blister is broke: And these *Effluvia* may be barely Fumes. Thus the Fumes of the *permeating Menstruum* have ting'd a piece of silver coin through a moistened urinary bladder

der; and a medicated liquor, injected into the thorax of a Person of Quality, gave him the tast and smell of the drugs, wherewith the liquor had been impregnated.

From the bringing off the matter of an *Apites* by seige, or urine :

From the staining *Ivory* Purple with a solution of Gold in *Aqua Regia*; blackish with silver, and blewish with copper, dissolved in *Aq. Fortis*. For proving the *Porosity* of *Bones*, he urges their specific Levity; that Blood vessels pass them; that they imbibe exhalations from the Air, and emit them again (as appears from the weighing bones at several seasons of the year;) and that Mercury has been found in the bones of some persons, who have taken of it.

The other *Essay* is concerning the *porousness* of *solid* bodies, which the Author proves, first *a priori*, from the Origine, and Formation of divers hard bodies; from the great disparity that may be found in the specific gravities of such bodies, as the Eye does not perceive to be Porous; from the frame, and constitution of solid bodies; for even they consist of particles which cannot be supposed to touch one another so exactly, as not to leave any Pore between them. Secondly *a posteriori*, from some experiments, and observations, arguing the Porousness of wood, Earthen vessels, stones, metals, and even glass itself, concerning which last the Author saies,

First, 'tis very probable that Glass may be pierc'd into, to some distance, even by visible and tangible bodies.

Secondly, common Glass is not ordinarily permeable by Chymical liquors, tho strong and subtil, nor by the directly visible, or odorable expirations of Bodies, tho absolutely speaking it be pervious to some corporeal substances.

Joh. Dolæi M. D. *Consiliarii ac Archiatri Hasso-Cassellani* ENCYCLOPÆDIA MEDICINÆ THEORETICO-PRACTICÆ, &c. Francofurti ad Moenum An. 1684. 4°.

The account of this book will best begin with the division of it into its six parts: The first treats of the diseases of the head; the second, of those of the Thorax; the third, of those of the Abdomen; the fourth, of Feavors; the fifth, of those incident to Women; the sixth and last, of those of Infants and Children.

This Author justifies the title he gives his book by accounting for diseases both as to their causes, and cure, according to the opinions of all Physicians both antient and modern; particularly of those who have given name to a Sect. He begins with the *Galenists*, whose opinions he faithfully relates: after them come *Paracelsus*, *Helmont*, *Willis*, *Sylvius* and *Cartesius*, whose natural philosophy hath laied the foundation of a party, though he himself was no Physician.

Having related these opinions as an Historian, (for he does not argue either for or against) he adds his own theory & practice. The *Anima Brutorum* with him is called Microcosmeter, which presides over the whole body; the other subordinate faculties, have their distinct names given them, and are described as Vice-royes residing in the principal viscera as in Provinces: Cardimelech in the heart; Gasteranax in the stomach, and so of the rest. In relation to these he describes the diseases in terms altogether political, and conformable to the general Metaphor of his Hypothesis.

His Practice is mostly Chymical, and seems to be carefully chosen; in which he gives a great deference to *Ettmuller* and *Sydenham*. He seems much inclined to transfusion

transfusion, and injection of medical liquors into veins, and quotes his own experience for it, in madness and some other diseases of the brain. And that there might be nothing wanting to his *Encyclopædia*, at the latter end of each chapter, he has collected Empirical remedies out of diverse Authors.

Disquisitio de Magia divinatrice & operatrice &c.
Auctore Francisco Moncæio 4^o Francofurti & Lip-
siæ 1683.

IN the General handling of *Magick*, he gives the several divisions Authors have made use of, different according to the divers conceptions they had of its parts. He makes it first, either *Humane*, or *Diabolical* with their respective *Species*. Secondly, *Natural*, or *Transnatural*, under which last he comprehends the *Transmutation* of *metalls*; under *Natural* come all the surprizing effects of *Art*, such as *Artificial fires*, *malleable glasse*, *incombustible linnen*, cures of Diseases by *magnetism* or *Transplantation*, *Strange effects in Chymistry*, and *Mathematicks* &c.

After this general account, follow's a very particular enumeration of its *species* to the number of about Sixty nine, alphabetically placed, together with the *Authors* that treat of them; out of all which the *Author* singles *Aleetryomancy* for the subject of this book.

He thinks that the strange antipathy (if true) between a *cock* and *Lion* may be accounted for, either from the disproportion of the sound to the *Lions* ear, as the grating of *knives* upon stone is unpleasant to us; or as the noise of bells, or singing, sets *dogs* an *howling*: or because in *Africa* there are no *cocks*,

cocks, or lastly, because though in other *countries*, as in *Theffaly* and *Macedonia* there are *cocks*, yet they never *crow*.

The *Auguries* taken from the *crowing* of *cocks*, according to him, depend chiefly on the time, whether it happen before noon or after, and accordingly portend either good or bad successe; to which some add the sign of the *zodiack*, and the *motion* of the *Moon*. Taking notice of *Plato's* definition of a *Man*, till the *Cynicks* real animal, spoil'd the *philosopher's Idea*, he gives an account out of *Dan: Major*, of the head of an old man with a *Turbant* on, which directly lookt on, appears such, but if you turn it on one side, it gives you the shape of a *Cock*.

From this presciene of *birds* he takes occasion to discourse about the *winter quarters* of the *Storks*, whether or no they go to, and come from distant regions as the seasons of the year require, and that so exactly (as some assert) as to observe the *latitude* of *places*, and the *precession* of the *Equinoctial* points. But having confuted this opinion by the inequality of their appearance, several instances of which he gives; concludes they do not fly to warmer *climates*, but, like other *animals*, both birds and beasts, come from hidden places in the same county, where during the cold they lye asleep. And afterwards gives as many reasons for it, as there are letters in *Hibernaculum Ciconiarum*, and that

too in the *Acrostick* way, each sentence beginning with a letter of those words, according to their order. Then he mentions some other *observation* concerning them, viz: that they will not build upon a *Jewes* house; that they have been seen industrious in quenching *fires* by taking water up in their bills, and emptying them into the flames &c. together with some guesſes how *Swallows*, and other birds which diſappear in *winter*, doe live.

He gives the original of the *names* of some *families*, and people, particularly of the *Gauls*, who, he is willing to think, were called so, from some good or bad property of this *bird*, and tells out of *Petrus Gregorius* and *Merkerus* that on the outside of the *brain* of a *Cock*, *Lillies* are drawn, or imagined to be drawn, alwaies one, and sometimes to the number of three.

The original of the *Cock* on *towers* he deduces from the *Goth's*, they making use of it much, both as an *Emblem* of *vigilancy* in peace, and of *courage* in war, some people are reported to have used them as *clocks*, they being supposed to *crow* every third hour, and when they are irregular, then they foretell *change* of *weather*.

He gives an account particularly of that sort of *Ale&tryomancy* which cost so many men their lives, under the Emperour *Valens*, whose names began with ΘΕΟΔ. those letters the *Cock* having pitcht upon, for the *Initials* of the name of his *successor*.

From

From the confideration of the *Cocks* being moved thus by *enchantment*, he takes occasion to difcours[e] of all sorts of motions which he reckons up to the number of 19. Beginning with *Artificial* motion, here he considers the *astrologers* opinion of what we call Freewill, how it is *mechanically* caused by the unequal motion of the *stars*, rather than from any determination from within; as also *Cartesius* his *mechanical animal*, *Coskinomancy* also, and all other sorts of *Legerdemain*.

Under the *Motus Belialis* comes the *Incubus*, together with the manner of driving it away; as all sorts of *Apparitions*, and the *Imaginary* journeys of witches. So under his *sympatberick motion* he comprehends the *Divining wand*, the *Remora*, the *Torpedo* and the *Heliotrope*: and after all, his accounts of the various sorts of unlawful motions, he asks this *question*, viz: what excuse the pretenders to these superstitions can make; and reckons up their *answers* according to the order and number of the *letters*, in *Præstigiæ Satanae excusatio*, all which he confutes. Under the internal force of words, is comprehended the *Cabala* with all sorts of *Signatures* and *Talisman's*, as also the art of *resolving Questions* by mixing the twenty four letters; and explaining doubts by verses of *Ovid* and *Virgil*, &c. As likewise some account of that natural language *Adam* was supposed to have had, by the very elocution of which alone, he exercised the *domi-*
nion

nion over the rest of the *Creation*. How Bears in *Norway* are called out of their *dens* by bad language : of breaking open doors by the word *bepatha*, the force of *Musick* &c. And ends, with reflections on a discourse of *Marcus Marci* in his *philosophia restituta*, wherein is endeavoured to be proved, that all effects how surprizing soever, are merely natural.

O X F O R D,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON. 1684.



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PHILOSOPHICAL

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Sept. 20 1684.

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A further account of the Bridg at Pont St. Esprit, whereof before, Numb. 160. together with a parallel History of some other Bridges at Rome: In a Letter from the ingenious Mr. Tankred Robinson to Dr. Martin Lister.

SInce my last concerning the *Bridge at Pont St. Esprit*, I have found something more in that kind for your further diversion; I doe not doubt but you still retain a fresh *Idea* of the stately ruins of the *Modern Bridge at Avignon*, which hath yielded in many places to the extreme rapidity, and violence of the *Rhosne*. Its fall in my opinion may be ascrib'd to three defects; first, it was not so *Multangular*, as that at *St. Esprit*: Secondly, it wanted in 3 or 4 places, the little Arches dividing the feet of the great ones, and in those parts it hath suffer'd most; for where those useful sluices are, there I observ'd the bridge to stand still the most entire. Thirdly, the *Pedestals* (or as you very properly call them, *Horizontal Arches*) were not so *Geometrically* and exactly laid, as those of *Pont St. Esprit*, their jettings out were few, and they not gradually contracted, so that the force of the stream must be the greater upon the Fabrick.

Now that we are upon this sort of *History*, I will venture to carry you from the *Rhosne* to the *Tyber*, which, though not so swift as the *Rhosne*, yet is subject to greater inundations, as many inscriptions assure us. No River
ever

ever had so many *bridges* built with that magnificence and art, as this ; and though they were more pompous, and rich in rare stones, in *Sculpture*, &c. than that I formerly sent you a draught of from *Montpelier* ; yet they had the like provision for their security, and preservation, and their design was much the same ; which may be seen at *Rome* this very day in the old *Pons Milvius* (now *Ponte nolle*) near the *via Flaminia* ; in the marble remains of the *Pons Æmilius* (repair'd with rich materials by *Antoninus Pius*) on the side of the *Ripa*, or *Trastevere*, near the root of the *Aventine* hill, where first the *Pons Sublicius* stood ; as also in the *Pons Fabritius* and the *Cestius*, that leads over to the *Insula Tiberina* ; in all which there are still very fair marks of the old *Roman* structure, and design ; and if that prodigious City had not been knock't so often to peices by barbarous Sackers, we might have had still as clear proofs from the other bridges ; viz. The *Pons Triumphalis*, the *Senatorius*, &c. But *Gothish*, and *Northern torrents* broke all before them.

I have here, *Sir*, according to your commands, drawn up in writing those thoughts, which I mentioned the other day to you ; So I rest,

S I R,

Your very Humble Servant

TAN. ROBINSON.

A description of a Bridg that may be built 70 foot long without any pillar under it, taken out of the Journal of the Philosophical Society of Oxford.

A *Timber Bridge* may be built 70 foot long or somewhat more without any *Pillar* under it, which may be useful in some places where *Pillars* cannot conveniently be built : It may consist of two such *Arches* of Timber, as that which is represented in the Figure, wherein AC and BO are Beams 28 foot long, and AB is 32 foot long. Under the Angles are set 2 large Braces EL and SR. At each end is a wall, on which are laid two Beams BH and AD, each 20 foot long ; under these are 2 Braces DE and RH. There may also be Braces at the ends of the Arches, that may be obliquely cross the Bridge. It may be laid with Planks and railed. Behind the walls are Causeys FD and HN. The Length of the *Bridge* CMO is 70 foot ; the Height KM is 19 foot.

Observations

Observations of the Eclipse of the Sun on the 12 of July last (new style) made at the Observatory at Paris 1684. in the lower apartment, by Messieurs Cassini and Sedileau; in the upper, By Messieurs de la Hire and Pothenot. At the College of Lewis the Great, in the presence of Monseigneur the Duke of Bourbon, by R.P. Fontenay; at Aix in Province; at Lyons; at the Bay of Roses; at Honfleur and at Pau; by divers other learned Persons.

In the lower apartment, by Messieurs Cassini and Sedileau.

For observing this *Eclipse*, beside the *Instruments* which were made use of for observing that of the *Moon*, at the *Focus* of the *Glass* of 40 foot, was placed circle of Paper equal to the *Sun's* Image, divided into 12 digits, by concentrick circles; and, to another *Glass* of 6 foot, was applied, on the *Parallatick* Engine, another circle equal to that at the *Focus* of the *Glass* of 40 foot.

The *Sun*, at the beginning of the *Eclipse*, was clouded; so that it could not be observed: but observations were taken of the following *Phases*, so as from thence divers others of the principal *Phases* might be collected according to the measures thereof, taken at such times as the *Sun* was free. The greatestt obscuration was seen, and the end of the *Eclipse*, which was exactly marked. And having adjusted the computation of time for the several observations, and compared them together; they were found in this manner,

The beginning of the Eclipse.	ho	'	"	Differences
One Digit	2	25	55	6' 55"
2 Digits	2	40	0	7 10
3 Digits	2	47	40	7 40

4 Digits

4 Digits	2	54	10	6	30
5 Digits	3	2	0	7	50
6 Digits	3	10	5	8	5
7 Digits	3	20	10	10	5
7½ Dig. the great- est occultation }	3	35			"
7	3	55	50		
6	4	4	10	9	20
5	4	12	25	8	15
4	4	19	15	6	50
3	4	25	50	6	35
2	4	32	15	6	25
1	4	37	40	5	25
End	4	43	23.	5	43

The apparent *Diameter* of the *Moon* appeared less than that of the *Sun*. It was judged that the Dilatation of the *Sun's* light, might make the *Moon's* Diameter seem less. The *Horns* or *Points* of the *Sun* Eclipsed seemed sometimes a little blunted by the *Glass*.

*In the upper apartment, by Messieurs de la Hire
and Pothenor.*

The conclusions following we deduced from a great number of observations of the *Sun's* obscuration, which were measured very carefully with a *Micrometer*. The beginning was not immediately observed, by reason of *Clouds*; but is concluded from many observations made soon after it. Wherefore this observation may be reputed as just as the rest. The *Sun's* greatest obscuration was observed very exactly; but the just time when it happened cannot be determined with the like preciseness, because there then happened no considerable alteration for the space of near two minutes. The end was observed with the greatest exactness possible.

	h		"	Differences	"
The beginning.	2	25	24	7	38
1 Digit	2	33	2	7	28
2 Digits	2	40	30	7	17
3	2	47	47	6	54
4	2	54	41	8	0
5	3	2	41	9	25
6	3	12	6	8	48
7	3	20	54		
The greatest obscure.	3	36	27		
7 dig. 5'	3	53	34	10	19
7	4	3	53	7	10
6	4	11	3	6	39
5	4	17	42	7	32
4	4	25	14	6	42
3	4	31	56	6	15
2	4	38	11	5	16
1	4	43	27		
End	4	43	27		

There were made also many observations of the distance between the seeming Horns of the Sun, which being compared with the Sun's lightsome part at the same time, and with the distances between the lines which joyned the Horns and the Suns farthest border, the Moons Diameter appear'd then not to be more than about 30 minutes; though by the observations of her Diameter made some days before and after, it was judged to be 31'. 30". but the being somewhat agitated, permitted not to observe exactly the extremities of the Horns, which appeared somewhat blunted; on which depended the exactness of that determination.

*At the College of Lewis the Great, in the presence of
Monseigneur the Duke of Bourbon, by R. P.
Fontenay, Professor of the Mathematicks.*

At hour 2. 29'. 30". the Sun which had been covered with clouds, being now a little uncovered, the Eclipse appeared.

peared sensibly begun; but not yet half a Digit, nor a third part.

	h	'	"
$1\frac{1}{2}$ Digit	2	37	40
2	2	40	25
3	2	48	34
4	2	54	30
5	3	3	0
6	3	12	40
7	3	22	18
$7\frac{3}{4}$	3	38	and more.
7	3	51	20
6	4	2	25
5	4	10	50
3	4	24	31
2	4	29	54
$0\frac{1}{3}$ fere.	4	41	

The Sun withdrawing behind the Clouds, hindred the observing of the end.

*An Abridgment of diverse other Observations, sent to
M. Cassini; at Aix in Province by M. the
Priour Gautier.*

The beginning at 2h. 54'. 30". The end at 5h. 9'. 9"
The greatness of the Eclipse $8\frac{1}{2}$ Digits. The Height of
the Pole 43d. 30'.

*At Lyons, in the great College of Jesuits, by R. P.
Paul Hofte.*

	By the Fix'd Stars			By the Sun.		
	h	'	"	h	'	"
1. Digit.	2	45	3	2	50	3
$8\frac{1}{2}$ Dig.	3	53	52	3	58	52
1. Digit.	4	59	20	5	4	20
	3	26	14	The Diameter of Sun and Moon. 30' 58"		
	4	20	34	The Diameter of the Sun 30'. 58.		
				of the Moon 30'. 5.		

The

The time of the greatness of the Eclipse at every of the Digits, was observed, but is not put into this Abbridgment

At the Bay de Roses, by M. Chaffelles.

	h	'	"
The beginning of the Eclipse	2	40	
The edge of the Moon at the Suns Center	3	25	
The Horns Horizontal	3	40	
The Horns Vertical	4	15	
The End of the Eclipse	5	1	30

The greatness of the Eclipse, about $\frac{3}{4}$ of the Suns Diameter. During the Eclipse, all the world saw Venus without pain. The place is 3 Miles in the Sea, before *Rosfes* 42d. 10' Latitude.

At Honfleur, by M. de Glos, Professor of Mathematicks.

	h	'	"
The Beginning, at	2	15	2
The End, at	4	34	35

The Greatness ; more than 8 Digits, but less than 9.

Other Observations communicated by R. P. Fontenay.

At Pau, by P. Richaud, Prof. of Math. and Theol.

At hour $1\frac{3}{4}$. The Eclipse not begun. At hour $3\frac{1}{4}$, at 10 D^{ts}. The end at $4\frac{3}{4}$. Height of the Pole 43. d. 30.

At Avignon, by R. P. Bonfa.

	h	'	"
The Beginning	2	43	27
1. Digit	2	51	58
9. Digits	4	2	
The Horns Vertical	4	24	32
$1\frac{1}{2}$ Dig.	5	1	16
The End	5	4	37

R

The

The Suns Diameter.

31' 38"

The Moons

30 6

M. *Cassini*, having compared together these Observations, and made such reductions as the *Parallax* requires, doth thence take these *Differences of Meridians* between the places of observation.

From *Paris* to *Aix*

14' to the East.

to *Avignon*

8½

to *Lyons*

8 or 13

to *Rosés*

4

From *Paris* to *Honfleur*

7 to the West.

to *Pau*

11.

The Observations of the Ancients concerning the Obliquity of the Zodiac, in a Letter of Mr. Edward Bernard to Mr. John Flamsteed Math. Reg.

De Obliquitate Zodiaci, Scriptores Græci.

Hanc reperit Eratosthenes, ante natum Christum an. 230. Grad. 23. atque insuper $51'. 19''. 31'''. 5''''$.

Distancia enim tropicorum ipsi fuit $\frac{11}{83}$ circuli Meridiani sive 47. gr. $\frac{59}{83}$. Ptol. *μεγ. σωτ.* p. 18. 21. Quare *λόξωσις* Eratosthenica minor erat Ptolemaica tantum $\frac{3}{83}$ unius minuti secundi, re sane contemnenda.

Eratosthenes apud Cleomedem, Ricciolo eruente, (supra grad. 23.) $46'. 00''$.

Eratosthenes à Ricciolo quasi correctus. $31'. 5''$.

Hipparchus (ante Christ. 140.) Eratosthenicam retinuit. Ptol. *σωτ. μεγ.* p. 18. & p. 60. Theonis, *ὅς ἀκριβῶς εἰλημμένον*. $51'. 19''. 31'''. 5''''$.

Tabulæ tamen Chovaresmicæ, conditæ post Christ. 830. exhibent Canonicam *λόξωσιν* Alexandrinorum, juxta MS. Lat. D. Hattoni $51'. 00''$.

Pytheas Massiliensis, ante Christ. 324. Ricciolo. $52'. 41''$.

Aristarchus ante Christ. 280. Illustri Savilio supputante, $51'. 20''$.

Aristarchus, ex ratiocinio Riccioli $30'. 00''$.

Strabo Geographus, pag 93. post Christ. 30. $\frac{4}{80}$ Circuli, sive præter gradus 23. adhuc unius, sive $60'. 00''. 00''''$.

Nec aliter Geminus (tempore Christi) Cap. IV. Element. Astron. Et Tatius c. 26. atque Proclus de Sphæra. Indique, sive Astrologi, apud Noddamum Arabem, Abrahamum Abenescdram, &c.

Noddamus Astronomus, qui floruit circa an. Domini 1200. notat *λόξωσιν* neque observatam unquam majorem gr. 24. neque minorem 23, 33': continuo tamen decrevisse.

Cl. Ptolemæus post Christ. 140. sæpius expertus & Crico suo & Plinthide, semper reperit proxime eandem cum Eratosthenica; $51^{\circ}.20''.00''$.

Distantia enim Tropicorum versabatur inter $47^{\circ}\frac{2}{3}$ & $47^{\circ}\frac{1}{3}$. Sed elegit pro Selidio suo $47^{\circ}, 42', 40''$. $\sigma\omega\tau.$ $\mu.$ $p.$ 18, 20, 21. & p. 27. capit pene medium, $\mu\omega\rho.$ $\kappa\gamma.$ $\nu\acute{\alpha}.$ $\kappa''.$ $\epsilon\gamma\gamma\iota\sigma\tau\alpha$. Nec aliter in Hypothesibus Planetarum. Theo vero in Canonibus $\pi\epsilon\rho\chi\epsilon\iota\rho\iota\varsigma$ facilitatis causa præterit minuta secunda. Fallitur autem Ricciolus, dum ex Climate Rhodi colligit $\lambda\omicron\zeta\omega\sigma\tau\iota\omega\varsigma$ modum pro Ptolemæo $23^{\circ}, 30', 00''$.

Pappus Alexandrinus (post Christ. 390.) l. 6. Theor. $35'$, Ricciolo $30'. 00''. 00''$.

Pappus, Fr. Commandino colligente $50'. 00''. 00''$.

Theo (post Christ. 370) pag. 88. accuratius $51^{\circ}.20''.00''$.

Alibi numero rotundo, ut p. 57. & passim in Canonibus suis $\pi\epsilon\rho\chi\epsilon\iota\rho\iota\varsigma$ nondum vulgatis $51'. 00''. 00''$.

Arabes Perseque.

Almamon Princeps, A. Christi 825. Hegiræ 210. 23. 35'. Grav. p. 44. ex Ebn-Shatir Damasceno MS. Seld. adfidentibus ei plurimis Astronomis. Ita etiam refert Abenesdras MS. Lat. in Archivis Digbeanis. Insuper Astronomus incertus in Arch. Seld. affirmat Iahia Ebn Abimansur cum multis aliis Philosophis, tempore Almamonis, $\pi\epsilon\rho\chi\epsilon\iota\rho\iota\varsigma$ experimento بالقياس deprehendisse. 23, 35'.

Idem tradit de observatis Almamonis Doctissimus AlNoddam in commentariis suis ad Astronomica Hotein Nisaburiensis. Imo addit ille eodem ævo sæpius observasse Beni Musa modum eundem gr. 23, 35. Bagdadi in campis. MS. Arab. Coll. S. Johan. Oxon. Hunc etiam placuisse plerisque sequentium Astronomorum. Sane in eo quiescit Alferganus Astron. suæ. c. 5.

Mohammed Ebn Gaber AlBatanius, (Al Bategnius,) Raccæ.

Raccæ. Ricciolo A. D. 880. Ill. Savilio 890. Gravio p. 44. 882. Hegiræ 269. Obiit ille Hegiræ 317, A. D. 929. Abolfaragi Hist. p. 191. 35'. 00'.

AlBatanius hac in re suas *τηρήσεις* præferre non dubitat Ptolemæi dictis, c. 4. atque se adjutum longissima Alhidada, seu Regula Parallactica ad formam Ptolemaicarum, cum cura & assiduitate reperisse apud Raccam tropicorum distantiam, 47, 10'. (hoc est, 59, 36' minus 12, 26'.) atque adeo Latitudinem Raccæ 35. gr. quam tamen Ulocbegus statuit 36. 10'. Schickardus apud Curtium (p. 33.) & Ricciolus gr. 36.

Thabet Ebn Corra (Ricciolo A. D. 1210. rectius 901. Hegiræ 289.) reperit *λόξωσιν*. 33', 30''.

AbulHolein Ebn Suphi. 35'. 00''.

AbulWafi AlBuziani, & Abn Hamed Saganienfis, vir ingeniosissimus, (A. D. 987. Heg. 377.) Bagdadi repererunt *λόξωσιν* tantum non 35'.

Ita & auctor *مسجد*, Persa in Arch. Seld. 35'.

Tabulæ itidem Persicæ Chrysococcæ 35'.

AlBatrunius AbulRihan (A. D. 995. Hegiræ 385. Abolfaragius hunc ponit ad Hegiræ 463. seu A. D. 1070.) usus quadrante, cui radius xv. cubitorum Grav. p. 44. ex Cod. Arab. Birunii. 35'.

Verum Abu Jaafer Alchazan, cum socio suo Abufadlo Harwanensi apud Edeffam, & istius ævi alii (A. D. 970.) observarunt *λόξωσιν* ad 23, 35': plane non accessisse, sed paulo fuisse minorem.

Almæon F. Almanforis (A. D. 1140 Ricc.) 33, 30', at ille Clavio & Mæstlino 33'.

Ismael Abulfeda princeps Hamæ (A. D. 1311. Hegiræ 711.) in tabulis suis MS. Arab. Coll. S. Joan. retinet forte ob Almamonis auctoritatem 35' 00'.

Prophatius Judæus (A. D. 1300. Ricc. 1303. Mæstlino apud Curtium p. 40. 230. annis post Arzachelem, inquit Copernicus.) & Ricciolo, & MS. Coll. Merton. 32. 00.

Abu Mahmund AlChogandi (A. D. 992. Hegiræ 382.) tempore Necroddaulæ, textante cujus radius erat cubitorum XL. limbusque in minuta secunda distinctus, invenerat $\lambda\omicron'\xi\omega\sigma\iota\nu$ minorem quam unquam captaverat aliquis majorum suorum, nimirum $32', 21''$.

Hinc Noddamus Astronomus affirmat (MS. Coll. Joan.) solis declinationem maximam vix unquam minorem fuisse repertam. $23. \& 33'$.

Arzachel Hispanus (Gravio p. 44. A. D. 1089. Hegiræ 482. Ricciolo 1070. Mæstlino apud Curtium p. 35. 1075. Copernico l. 3. c. 6. annis 190. post Al Batanium) proposuit $\lambda\omicron'\xi\omega\sigma\iota\nu$. $23. \& 33'. 30''$. Ita MS. Coll. Mert. Ox. ubi dicitur differentia $17', 30''$, intercedere inter $\lambda\omicron'\xi\omega\sigma\iota\nu$ Ptolemæi & Arzachelis.

Apud Maragam Nobilissimus Persa Chojah Nasiroddinus Tufenfis anno Domini 1269. Hegiræ 668. (at Gravio p. 44. 1261. Hegiræ 660.) accuratissime observavit $\lambda\omicron'\xi\omega\sigma\iota\nu$ $23. \& 30'. 00''$.

Hæc est minima ex maximis solis declinationibus, quæ ad hunc usque diem reperta fuit, ait Doctiss. Commentator ad Astronomica Holsin Nisaburiensis.

Ebn Shatir Damascenus MS. Seld. A. D. 1363. ait se emendasse $\lambda\omicron'\xi\omega\sigma\iota\nu$, non neglecta solis parallaxi, quæ horizontalis capta est gr. 2. 59'. Huic solis max. declin. $23. \& 31. 00$.

Olocbegus Princeps A. D. 1437. Hegiræ 841. cum Aly Culhgio aliisque Astronomis, usus summa cura, & maximis instrumentis, (vide Gravium p. 44.) reperit $\lambda\omicron'\xi\omega\sigma\iota\nu$. $23. \& 30'. 17''$. Ita MSS. Coll. D. Joan. & Bibliothecæ Savilianæ. Nam MS. Seld. exhibet $23. 30' 27''$.

Rabbi Moyfes ben Maimon Judæorum doctissimus ait in Jad. de Consecratione Calendarum c. ult. §. 4. maximam Zodiaci obliquitatem fuisse A. D. 1174. $23. \text{gr.} \& 30. \epsilon\gamma\gamma\iota\sigma\alpha$.

Josephus vetat, mi Frater, ne quid amplius ad te scribam hac de re. Scias tamen vix dimidiam partem Astronomorum,

astronomorum Orientalium, quorum scripta hujus Academiæ Bibliothecis servantur, à me consultam fuisse. Optimum aliud expecto. Valeto. Habent etiam Bibliothecæ Bodleiana, Mertonensis, Huntingtonia, illa Serenissimi Regis in Palatio Jacobæo, tum aliæ per Angliam; unde juvari delectarique potest vir de Cœlo bene meritus D. Streetius. Dolet me, quod nunc non vacat tam bono viro.

Oxon. Aug. 14. 1681.

De indole ac natura Cometarum ego plane χαλδαῖζω: quod tamen cum laude aliter sentientium, cum tua maxime facio. Vale rursus mi amice, Ocelle Astronomiæ.

Hæc talia bis scribere non soleo. Servabis igitur penes te, non tam Uraniæ causa, quam mea.

Ex hisce autem Observatis aliisque quæ mecum adhuc cis vulgus servo, unam eandemque suspicor fuisse à primordio mundi ἀβύσσιν Zodiacam. Æva enim recentia, quod vides, melioribus organis errorem excessumque veteris Astronomiæ probe correxerunt.

An account of a Salt Spring, and another Medicinal Spring, on the banks of the River Weare, or Ware in the Bishoprick of Durham in a Letter to the Publisher, from the ingenious Mr. Hugh Todd Fellow of University College in Oxon, and Chaplain to the right Reverend Father in God ----- Lord Bishop of Carlile.

S I R,

I Am so much oblig'd to you for your many Favours when I was with you ; that now, when I am at so great a distance from *Oxon*, I cannot pass by any opportunity of serving you, in visiting the *Curiosities* of *Art* or *Nature* (with which the *Northern* parts *Durham*, and *Cumberland* especially, do abound) and in giving you an account of what, I judge, may be worth your knowledge.

When I was at *Durham* I was informed of an extraordinary *Salt-Spring*, and another *Mineral-Spring*, about a mile, or a mile and half out of Town. Upon the first leisure time that I had, I went to see them ; as I found, some of the *Lawyers* that came the *Circuit*, and many other *Gentlemen* had done.

The *Salt-Spring*, lyes, as I said, about a mile and half out of Town, on the North-East side, at a place called *Salt-water haugh* near *Butterby*. It rises in the middle of the River *Weare* or *Ware* ; and is good to be seen, and tasted, only in the *Summer* time, when the water is discharg'd all, on one side of the *Channel* : for in *Winter*, when the River is high it looses its *Salts*, in the fresh streams, so that they are not perceivable. The water does not rise at one or two or three places, but seems to bubble up equally in all parts in the *Channel*, for the space of 40 yards in length, and about 10 in breadth : for, wherever,

wherever, in that *Spot*, you remove the stones and sand, you shall perceive the water, presently arise and spring up. That, which I admired most, is, that the *sa'test* of all the Springs, issues out of the middle of a *Rock*. I supposed that the brinyness of its waters might be caused by the *heat* of the *Sun*, continually beating upon them, as they lay upon the *Rock*; the surface of which was manifestly saltish; and which, in a *hot* day (as I was told) would be all covered over with a perfect *Salt*. But I was undeceiv'd in this conjecture, by having all the water lay'd out of the place, where it seem'd to stagnate: for immediatly, out of the body of the *Rock* there bubbled up water, as salt as the former. As to the degree of its *saltiness*, it was as high, as any brine can be, and tho but little in quantity in comparision of the *fresh River*, yet of that force as to give a brackishness to the *streams*, a 100 yards below. Those that have boyled this *Brine*, (I had not time to try the experiment my self,) say that it affords a great quantity of *Bay Salt*, not so palatable, yet as useful as ordinary *Salt* is. It tinges all the stones with a *Red colour*. The original of this *Spring*, cannot be fetch'd any farther off, then the *Rock*, out of which it issues; for the *Sea*, which is the great *Treasure* of *Salt-water* is at too great a distance, to dispence any streams to this Place: being 8 miles off, where nearest.

On the other side of the *River*, there is lately discover'd a *Medicinal Spring*, which is, this year much frequented, and may be of great benefit to the *Country*. It was found out, by *workmen* that dug in that place for *Coal*. When they were 12 fathom and a half deep, they discover'd this *Treasure* of *Natural Physick*; which may be as good to the people, as what they sought for; tho *Coal*, be a Commodity very necessary and beneficial to these *Parts*. The workmen thus failing of their *Expectation*, try'd the *Rock* about a 100 yards off: where they lost

S

them-

themselves, much about the same depth; and instead of Coal, discover'd a Spring of excellent clear Water, which issues out at the Hole, which their Instruments made. I tell you this, that you may confirm your *observations*, of the many different apartments there are in the Earth; and with what different *Treasure* they are furnish'd.

I can say no more; I will only promise what I will say another time; and send the first opportunity. I will give you an account of a *Runick Inscription*, (mention'd but not understood by Mr. *Camden*,) on the *Font* in *Bride-kirk* in *Cumberland*. I shall tell you something too, of two very *Ancient Monuments* something of the form of *Stonehenge*, but they seem far more ancient. And shall as I am able, give you Excripts of many Roman Inscriptions, which abound in this Country.

In point of obligation and gratitude; I will send you some *Roman Urns*, which I had at *Durham*. A piece of the *Salt Rock*, where the *Spring* issu'd out, which is of a sparkling substance. And if you will be at the Cost of *Carriage*, I will endeavour to send the *Stones* that have the Inscriptions on them. Where I can have them, I shall not omit any Opportunity to serve you, and the *Society*. Pray let me have what *Queries* you think fit to be satisfy'd in; and some *Rules* to direct my *Disquisitions*, by the first *Opportunity*: that when I visit all the Parts of this Country, which will be shortly, I may be the abler to serve you.

I have made enquiry, as to the *Longevity* of those that live in Mountainous Parts: and find, by Relation, that they out-live any that I have heard off in the *South*: but, that I am so unhappy, as not to be able to make any perfect account, about that Affair. The next *Spring Visitation* will give me opportunity, to consult the *Registres* and *Church-Books*; and so make me
abler

abler to give an exact, credible Relation, which I shall be fure to doe.

As I Travell'd over *Stanemoore* in *Yorkshire*, I observ'd the River *Greatah*, (a River about half as big as *Charwell* at *Oxford*) run under ground for about a Mile, so that we pass'd over it, dry-foot. The passage under ground is but narrow; so that in winter when the streams are high, it keeps the Channel above ground.

S I R, I am

Your most Oblig'd Friend

and Humble Servant

HUGH TODD.

Exercitatio Geometrica de DIMENSIONE FIGURARUM, Authore Davide Gregorio, in Academia Edinburgenfi Matheſeos Profefſore. Edinburgi in 4°. 1684.

IN this Treatiſe, the Author firſt takes notice of a Treatiſe of his Uncle Mr. *James Gregory* printed at *Padua*, in the year 1667, entituled *Vera Circuli & Hyperbolæ Quadratura*, &c. Wherein he ſhews, that any Sector of the Circle, Hyperbola, or Ellipſe, is, the termination of a certain Converging Series; whoſe two firſt Terms are A and B; whereof A is a Triangle, which, as to the Circle or Ellipſe, is Inſcribed; but, as to the Hyperbola, Circumſcribed, to the ſaid Sector: and B, a Trapezium, which (contrarywiſe) as to the Circle or Ellipſe, is Circumſcribed; but as to the Hyperbola, Inſcribed, to the ſaid Sector: The two ſecond terms, $\sqrt{AB}$ and $\frac{2AB}{2+\sqrt{AB}}$: the two thirds, in like manner derived from the ſeconds, as theſe are from the firſt. And ſo infinitely, with other things appertaining to the ſame, and to other ſuch like approximations.

He then mentioneth another method, (different from that former) published at *London*, the year following, by Mr. *Nicolaus Mercator*, in his *Logarithmotechnia*, for ſquaring the Hyperbola, by the help of *Infinite Series*. Approved alſo, and demonſtrated, afterwards, by Mr. *James Gregory*, Apagogically. But, that a General method, for ſuch caſes was yet wanting.

That about the beginning of the year 1670. he underſtood from Mr. *John Collins*, that Mr. *Iſaac Newton* (Profeſſor of Mathematics at *Cambridge*) had, before that time, a General method for ſuch Quadratures, and other like

like cases. Whereof (as an Instance) Mr. *Collins* sent him an example, of such an Infinite Series, accommodated to a Circular Zone; namely, if the Radius be R, and the breadth of the Zone B; the Zone is equal to

$$2RB - \frac{B^2}{3R} - \frac{B^3}{2 \cdot R^3} - \frac{B^4}{5 \cdot R^5} - \frac{5B^5}{576R^7} - \&c.$$

That Mr. *James Gregory* was in pursuit of like methods of *Infinite Series*; but was prevented by Death; and (beside some particular examples) left nothing in his Papers (yet come to his hands) that might declare his method and way of finding such examples.

That himselfe (Mr. *David Gregorie*) doth (in this treatise) make it his business to explain a method, which may suit such examples of his Uncle.

And he doth here assume (though in other words) the Doctrine of Indivisibles, and the Arithmetick of Infinites, as already known; and received by Geometers as sufficiently Demonstrated. And applies this to particular cases, in this manner; Supposing a streight line or Axis, which he calls X, cut into parts infinitely small, and the respective values of each L (which he calls *Elementum*,) or small part of the Curve, Plain, or Solid which is to be measured; answering to each of those particles of X; (or at least somewhat so near the values of L, as that the difference may be neglected; as when a short Subtense or Tangent, is taken as coincident with a Curve;) he doth (according to the Doctrine of Infinites) collect the Aggregates of all such L; which Aggregate is the Magnitude sought.

Of this he gives diverse examples in Parabola's, Hyperbola's, Elliptics, Spirals, Cycloids, Conchoids, Cissoids, and some other Curves, or Curve-lined Figures; as to their Area's, and Curve-lines, with the Solids, and Curve-surfaces, made by conversion of them, or otherwise derived from them.

Together

Together with divers expedients, or preparative observations, (by Division, and extraction of Roots, in Species,) for reducing of implicated quantities (when need requires) into infinite series; thereby rendring them capable of having the method of Infinites applied to them.

And concludes, with expressing his hopes and expectations, that Mr. *Newton's* methods to this purpose (long since contrived, but not yet published in Print) will now shortly be made publick.

L' Art de Tailler, &c. The Art of Pruning Fruit-Trees, and a Tract of the use of the Fruits of Trees, for preserving us in health, or for curing us when we are sick. Translated from the French Original, set forth the last year by a Physitian of Rochel. Printed at London in 8°. 1685.

THe Author of this Book, who is a member of the College of Physitians at *Rochell*, having taken a particular delight in the Cultivation of Fruit-Trees, and in considering the use of their Fruits, gives us here the rules which many years experience has taught him on those subjects; he conceiving to have herein outdone what any man has yet written on the like occasion.

The first part of this Book, which contains the Art of Pruning or Lopping Fruit-Trees consists of four Chapters, and the Author has caus'd seven Figures to be Grav'd, which he judg'd necessary for the understanding of what he says. The first Chapter treats of the Lopping of Fruit-Trees for the Month of *February*. The second explains that of the Month of *May*. The third teaches the Lopping for the end of *May*, and for the beginning of *June*. And the fourth comprehends that of *July*.

The Tract of the use of fruits has three Chapters, divided into several Articles: In the first Chapter he shews the time and the way of using Fruits which corrupt easily, as Figgs, Necterins, Peches, Plums, Apricocks, Mulber-ryes, Cherryes; which ought allways to be eaten, the Stomach empty and before meals. The second treats of those which do not corrupt easily, and which ought to be eaten after meals, as Pears, Apples, Portugal Quinces, Medlers, and Services. The third explains how we may eat before or after meals Raisins, *Portugal* and *China* Oranges,

Oranges, *Spanish* Pomegranates, and Corands. Speaking of Raisins, he tells us of an excellent sort of drink made of dry'd Raisins, call'd *Cabal*. They take out the stones of fifteen or twenty pounds of Raisins, and then they bruise the Raisins a little: and in the Month of *January* or *February*; at which time Raisins are brought them from *Spain*, they put them into a barrel of excellent White-wine to be drank at Easter. This Wine, he says, will have the colour of Sack, it will be pleasant to the tast, and will have qualities not to be Contemn'd: for it lenifies the breast, allays Coughs, helps Respiration, and fortifies the Stomach and Liver, gives an Appetite, stops Looseness, opposes inclinations to Vomit: In a word it is an excellent Remedy for the Dropsy, and it wonderfully agrees with old Men, Valetudinarians, Flegmatick and Melancolick Persons, and with tender Women. *So far the Author*. It is conceiv'd that if a tryal be made with a like quantity of Raisins in our English Beer or Cyder, it may prove no contemptible drink. This book is newly put into English, and sold by *Tho. Basset* at the *George* *St. Dunstons Church in Fleetstreet*.

E R R A T A.

P Ag. 595. l. 18. r. *Viviparous* l. 28. r. *Bassenburne*. p. 596. l. 20. r. 1670. p. 598. l. 27. r. 1670. p. 671. l. 19. for read r. tried. p. 699 l. 1. for a *Journal*, r. the *Journal*. l. 3. for read r. tried. l. penult. for wrinkles, r. wrinkles. p. 701. after [but broken off in Separation] add [the lines of this Figure should have been made to run secundum longitudinem Stomachi, to represent the Fibres of the inner tunic, running that way, as in B B B B of Fig. 10. as they now run, they intimate that those Fibres are circular, for which there is no foundation in nature. p. 714. l. 14. r. lie.

O X F O R D,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* *LONDON*. 1684.





PHILOSOPHICAL

TRANSACTIONS.

Octob. 20 1684.

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Two Letters from the great, and experienced Oculist, Dr. Turberville of Salisbury, to Mr. William Musgrave S. P. S. of Oxon, containing several remarkable cases in Physick, relating chiefly to the Eyes.

The first Letter.

S I R,

UNDERSTANDING that your *Philosophical Society* has lately received accounts of some unusual Distempers of the *Eyes*, and that more accounts of this nature will be welcome to you, and are desir'd of me in particular; I should not act suitable to the great respect, which I have to the worthy *Gentlemen* of that *Society*, should I not endeavor to answer the expectation they have of me.

The Disease, which, in some late discourse with you, I named *Bursa Oculi*, or *the Pouch of the Eye*, was a Bag without matter in it, (like an empty purse,) on the white of the Eye, under the upper lid; it hung flag about the length of a thumb nail. Another person had no visible disease in his Eyes, but could not see at all, unless he squeezed his Nose with his fingers, or Saddled it with narrow *Spectacles*, and then he saw very well: him I carried to Mr. *Boyl*, as a fit subject for so great a *Philosopher* to make his remarks on.

A Maid, two or three and twenty years old, came to me from *Banbury*, who could see very well, but no colour beside *Black* and *White*. She had such Scintillations by night, (with the appearances of Bulls, Bears, &c.) as terrified her very much; she could see to read sometimes in the greatest darkness for almost a quarter of an hour.

If

If your Society will give me their thoughts on these Distempers, they will very much oblige their, and

Your humble Servant,

London Aug.
4th 1684.

Dawbeney Turberville.

The second Letter.

S I R,

THe kind reception, which your *Society* gave those observations, I sent you from *London* not long since, does encourage me to add these which follow. I will relate them to you in few words; as considering that I write a *Letter*, not a *Discourse*. A Sadlers Daughter of *Burford*, had an Impostume which broke in the corner of one of her *Eyes*; out of it there came about 30 stones, as big as pearl, and splendid; after which she had a *Fistula*; came to me to be cured; and went away not deceived in her expectation.

Here was one in *Salisbury*, who had a piece of Iron, or Steel, stuck in the Iris of the Eye; the Person was in very great pain, came to me; I endeavor'd to push the Iron out with a small *Spatula*, but could not; I then applied a *Loadstone* to it, and immediately it jump'd out.

A Man came to me, complaining that he had a long time been troubled with a great pain, and convulsions in his Cheek; you might cover the place, where the pain was, with a penny; the Convulsions pul'd his Mouth, Face, and Eye aside: he had used many things prescribed him by *Physitians*, and *Chirurgions*, but to no purpose: I applied a Cupping glass to the place, with fired flax in it;

I then scarified, and cup'd him again; after which I put on a plaister of *Diapalma*, and he was perfectly cured.

I was consulted by a Maid, who had a puffle broke in her Eye, out of which there came fine small sand, like Chaulk, for many Weeks together: I made use of Purg- ing, Fumigation, and some Topics, by which she recovered her sight in a very great measure.

If you please you may report these *Observations* to your *Society*, and if these are judg'd worth consideration, some others may be communicated by

Your very humble Servant,

Sarum Oct.

5th. 1684.

Dawbeney Turberville.

An

An Ingenious proposal for a new sort of Maps of Countries, together with Tables of Sands and Clays, such chiefly as are found in the North parts of England, drawn up about 10 years since, and delivered to the Royal Society Mar. 12. 1683. by the Learned Martin Lister M. D.

WE shall then be better able to judge of the make of the *Earth*, and of many *Phænomena* belonging thereto, when we have well and duely examined it, as far as human art can possibly reach, beginning from the *outside* downwards. As for the more *inward* and *Central* parts thereof, I think we shall never be able to confute *Gilbert's* opinion thereof, who will, not without Reason, have it altogether *Iron**. And for this purpose it were advisable, that a *Soil* or *Mineral Map*, as I may call it, were devised. The same *Map* of *England* may, for want of a better, at present serve the Turn. It might be distinguisht into *Countries*, with the *River* and some of the noted *Towns* put in. The *Soil* might either be coloured, by variety of *Lines*, or *Etchings*; but the great care must be, very exactly to note upon the *Map*, where such and such *Soiles* are bounded. As for example in *Yorkshire* (1.) The *Woolds*, *Chaulk*, *Flint*, and *Pyrites*, &c. (2.) *Black moore*; *Moores*, *Sandstone*, &c. (3.) *Holderness*; *Boggy*, *Turf*, *Clay*, *Sand*, &c. (4.) *Western Mountains*; *Moores*, *Sandstone*, *Coal*, *Ironstone*, *Lead Ore*, *Sand*, *Clay*, &c. *Nottinghamshire*, mostly *Gravel Pebble*, *Clay*, *Sandstone*, *Hall-playster*, or *Gypsum*, &c. Now if it were noted, how far these extended, and the limits of each *Soil* appeared upon a *Map*, something more might

* De Magn. Lib. 1. Cap. 17. *Tellus in interioribus partibus magnetica homogenicam naturam habet.*

be comprehended from the whole, and from every part, then I can possibly foresee, which would make such a labour very well worth the pains. For I am of the opinion, such upper *Soiles*, if natural, infallibly produce such *under Minerals*, and for the most part in such order. But I leave this to the industry of future times.

I shall entertain you at present, with a *Scheme of Sand*, and another of *Clay*, such only which I have had the chance to meet with in *England*. As for the *Sand*, I have some reasons to think, that it was once, the most exterior and genera cover of the surface of the whole Earth. Because all our *Northern Mountains* are more or less covered with it at this day, and the higher the *Mountains*, still the more, and the courser the *Sand*: Because the *Rivers* arising in the *Mountains* do yet daily bring it down in great quantities, and that it has been so in all probability, in all Ages, since the first rains fell upon the face of the Earth, which seems to me to be truth like, in that the *Sea-shoares*, or Mouths of *Rivers*, are usually barr'd with it; Besides the *Sandy Sea Grounds* in most places of the *Sea*; and (which seems a clear evidence for the length of time) for that, the low grounds near these *Rivers* (which have been in all ages upon Record, *Mosses*) if you pierce so deep into them, as to discover their bottom; you meet with this *Mountain Sand* in great quantities, and in some places a *Mosse* under that, and the same Sand-beds under that. Now if we consider how long these *Mosses* or *Turf* is in growing, it being mostly the leaves and roots of Plants, we must allow very many ages for this purpose. And although *Herodotus* one of the most Ancient *Historians* that are, boldly conjectures that *Egypt* long before our times, would be dammed up and useless by the great plenty of *Mud* yearly brought down that vast River; yet it does not appear, that the *Country* is much different from what it was in his time, so that the *Sand* and *Mud* is still carryed to Sea.

Another

Another Argument of the Sands being the *Universal Cover* of the face of the Earth is, from the great hardness, and consequently the durableness, and unalterable quality of this *Mineral*, above any other in *Nature*. For though many things are called *Sand*, from the smallness and little Cohæsion, or dryness of the grains, yet this kind of *Mountain Sand* above all others keeps its natural and original magnitude, and is not made (as most Sand is) by the Attrition and wearing of one particle of stone against another; But is of a constant and durable figure; and therefore, I say, it seems to me for this reason to be the most fit for an *outside* or *cover* to the *Globe* of the Earth.

And if it shall be objected, that although we grant the high Mountains of *England* and *Europe*, are usuall; first bedded with *Sand-Rocks*, if not still covered in many places with loose sand, yet are there other *Mountains*, as the *high Woolds* all over *England*, not so, but their uppermost beds of stone are soft Chaulk. and on the smooth surface no appearance of any *Sand*. This indeed is in part granted; but that there is no where any *Sand*, upon the *Chaulk Mountains*, is not true; for to instance in those inland *Sand Hills* above *Bulloine* in *Piccardy*, which sand is the very same with that on the Sea shoar at *Calais*, and although this is not *England*, yet the Sea hath but accidentally divided us: for from *Dunstable* Ex. gra. in *England*, even as far as the *Walls* of *Paris* by *Calais*, is as it were a continued *Woolds* of *Chaulk* and *Flint*. What difference there is betwixt the *Woolds* Mountain sand, and that of the *Northerne Mountains* will best appear in the Table. Now the nakedness of the *Woolds*, is from the smallness of its sand, which readily yielded not only to the *Rain* that fell, but to the *Wind* also. Which is evident from that vast tract of sandy Hills, which bound the coasts of *France*, *Flanders*, and *Holland*, and which have made their *Coasts* so shallow in respect of *ours*, as being

in

in great part blown off the *Yorkshire, Lincolnshire, Suffolk, or Essex, and Kentish Woolds*, and wrapt up upon their *Coasts*; and the reason of this is partly from the more constant *Westerly* winds blowing over from our *Coasts*; and also from the meeting of the two *Tydes*, viz. that of the *Channel*, and that other of *North Flood* upon their *Coasts*.

I am well aware, that the finding of *Cockles* or *Shells*, as most *writers* are pleased to call them, upon *Mountains*, and sand also there, is by the same *Herodotus* used as an Argument of a great *Deluge*, or inundation of waters; but as I have elsewhere I think demonstrated, that the *Rock-Cochlites* are no *Shells*, so neither can I grant that the *Sand* was adventitious to the *Mountains*, but naturally originated there; for that it is there plainly to be found, some loose, and the rest in Beds, yet unloosened; as I could name very many places, for instance, *Silden* and *Thorpe Fells* in *Craven*, this *Mountain Sand* is a white and transparent pebble, and some of it is small and easily swept and blown away, so is there much of it upon the high *Mountains* mixt with white pebbles of greater Size.

'Tis the *Character* of this sand, not to yeild to fire, as *Flint* will do; and though it agree with that and some other *metalls*, to strike fire from *Steel*, yet it does not *cal-cine*, as *Flint* will be brought to doe. And therefore this *Sand* is the true *Tarso* of the *Italian Mountains*, of which the fine *Venetian Glass* is made; and for this reason, the *Flint-Glasses* were here in *England* ill compounded, the *Forreiners* mistaking the *materials*, which yet our *Country* affords in plenty, all over the *Northern*, and (I doubt not) the *Westerne* mountains too: I have seen from the *Scotch mountains* very excellent and large.

A Table of Sand (drawn up about X. years since) such chiefly as I have found in the Northern parts of England.

Sand.	Sharpe or Rag-Sand, composed of small transparent pebbles, naturally found upon the Mountains, not calcinable.		
	{ Fine	{ White	{ <i>Stritneham</i> Moor in the Road wash'd up very white Pebble. <i>Flamborough</i> head, of which the Light house there is cemented.
		{ Grey	{ <i>Calice Sand</i> ; burns reddish, but falls not in water.
		{ Reddish Browne	{ <i>Seaton Banks</i> near <i>Hartlepool</i> or the <i>Tees</i> mouth, <i>Escrick</i> , in the Gravell pit there.
			{ A vein of exceeding fine Sand.
			{ The Pillow Sand in the <i>Baltick</i> .
			{ In a Spring at <i>Heshington</i> .
			{ The Sand at the <i>Bath</i> in <i>Somersetshire</i> .
	{ Courfe	{ Greisly	{ <i>Acome</i> near <i>Tork</i> drifted Sand.
			{ <i>Hutton Moor</i> washt.
			{ <i>Thorpe Fells</i> .
			{ <i>Owze</i> at <i>Tork</i> .
			{ <i>Nid</i> at <i>Mountain</i> .
			{ Dug up at <i>Rawcliff</i> near <i>Snatb</i>
			{ <i>Wharfe</i> at <i>Ickly</i> and <i>Denton</i> .
			{ <i>Air</i> at <i>Carleton</i> in <i>Craven</i> .
			{ <i>Eure</i> at <i>Bolton</i> .
		{ Browne	{ <i>Gauton</i> .
			{ <i>Santon</i> in <i>Lincolnshire</i> .
			{ <i>Bomeby</i> Common.
			{ <i>Skipwith</i> Common.
	{ Soft or smooth with flat particles.		

{	From Limestone.	{	At in <i>Yorkshire</i> .
			A Vein at <i>Oswell Beacon</i> in <i>Lincolnshire</i> .
{	With <i>Mica</i> of Glittering particles,	{	Sea sand about the <i>Sylly Islands</i> .
	Silver like		In <i>Cleveland</i> and about <i>Scarborough</i> .
			<i>Onze</i> dust, or sediment at <i>Raw-cliff</i> .
	Gold like		A Vein of <i>Mica</i> in <i>Heslington Gravel Pit</i> .
{		{	<i>Mica Argentea</i> in Red sand Rock near <i>Rippon</i> plentifully.
			<i>Mica Aura</i> of <i>Cleveland</i> .

Allo I here give a Scheme of *Clays*, as well because it seems to be another Coat of the *Terrestrial Globe* in the more depressed and hollow parts thereof, as because the mixture of *Sand* and *Clay* is not unusually called *Earth*. Yet this terme being too large it will be convenient, as I think, to limit it to such a mixture as we usually find upon the surface of the ground, which hath ever in it, besides such *Sands* and *Clays*, as either the *Soyle* naturally produces, or have by *Floods* or *Winds*, or other accidents been brought thither, a great part of the rotten parts of *Plants* and *Animals*. And in this sense *Turff* is *Earth*, which is mostly where the *Erica* or *Heath* grows, because it is made up of the deciduous Leaves of that *Plant*, which being by the Current of showr's brought together, make up the *Moores*, *Mosses*, and *Fens*, and in the *Mountains* in hollow *Basons* or *Depressures* without Vent; *Mosses* of incredible depth, 1. or 2. *Fathom* ordinarily in the same kind of Black *Earth*, called *Peat* or *Turff*.

[*A Table of Clays.*]

Pure, that is, such as is soft like Butter to the Teeth, and has little or no greetiness in it.

Greasy, to be reckoned amongst the Medicinal Earths, or *Terræ Sigillatæ*.

1. Fullers Earth

{ Yellowish { At *Brickhill* in *Northamptonshire*.
 { At under the *Yorkshire*
 Woolds.
 { Brown about *Hallifax*.
 { White in *Derbyshire* Lead Mines.

2. Boli { In *Cleveland*.
 { At *Linton*, upon *Wharfe*.

3. Pale yellow, in the Marle pit at *Ripley*.

4. Cow shot clay, or the Soap scale lying in Coal Mines.

5. A dark blew-clay or Marle at *Tolthrop*.

Harsh and dusty when dry.

6. Creta properly so called, or the Milk white Clay of the Isle of *Wight*.

7. The Potters pale yellow Clay of *Wakefield Moor*.

8. The Blew Clay of *Bullingbrook Pottery* in *Lincolnshire*.

9. A Blew clay in *Bugthorp Beck*, in which the *Astroites* are found.

10. Yellow Clay in the seams of the Red sand Rock at *Bilbro*.

11. Fine red clay in Red sand { at *Bilbro*
 Rock, { at *Rippon*.

12. A soft chalky blew clay } { at *Buttercrain*.

13. A soft chalky red clay } {

Stony when dry.

14. A Red stone clay { In the Banks of
 { *Whitcar* beck, near
 { *Leppington*: & at *Hou-*

15. A Blew stone clay } sam in the *Milscar*.

16. Clunch, a white stone clay in *Cambridgsh*.

Mixt with Round Sand or Pebble.

- 17. The yellow Loame of *Skipwith Moor* *Yorkshire*.
- 18. A Red sandy clay in the right hand bank of the Road beyond *Collingham*, near the lime Kilns going to ----
- 19. A Red sandy clay in the Red sand Rock near *Rippon*.

With flat or thin sand, glittering with *Mica*.

- 20. *Crouch* white clay *Derbyshire*, of which the Glas-pots are made at *Nottingham*.
- 21. Grey or blewish Tobacco Pipe clay at *Hallifax*.
- 22. A Red Clay in the Red sand Rock at *Rotherham*.

Observations

*Observations of the Solar Eclipse July the 2. 1684.
at Oxford, sent in a Letter from Dr. Edw. Bernard,
Astron. Prof. Oxon. to Mr. John Flamsteed, Astron. Reg. At Lisbon by Mr. Jacobs; at
Dublin, by Mr. Ash and Mr. Molyneaux; and
at Tredagh by Mr. Osburn.*

Johanni Flamstedio Edwardus Bernardus S.

Quotidie crescit tibi è Cœlo gloria. Sive novas Æt-
nas in orbe solari deprehendas ante alios, & quasi
illæ è proximo eminenter accurate admodum metiaris:
Sive magni istius luminaris, unde lux & vita rerum, præ-
dicas defectus, non temere & fortuito; sed quo maxime
vultu quove temporis momento contingere oportuit, &
eventus nos omnes docuit. Recte facis, mi frater, quod
duos temporum & seculorum nostrorum arbitros diligen-
tius contemplaris; & post observationis curam & indu-
striam, planissimis theoriis, quibus nihil ingeniosius, per-
gis demonstrare. Cæterorum equidem planetarum mo-
tus minus ad nos pertinent, aut in tanta amplitudine na-
turæ multas anomalias dissimulant ac obliterant, quas in
luna tam vicino fidere vel inviti observamus. Quid in nu-
pera Eclipsi notavimus, ex subsequente Canonico facile
intelliges, quid etiam præterivimus, tam cœlo claro
quam nubilo. Phases autem quadraginta illius defectus
captavit definivitque bona manus Wallisii. Tempus eti-
am justum æquumque ejusdem deliquii altitudinibus ali-
quot solaribus comprobarunt clarissimi viri D. Casvellus
& D. Rookius, ubi horologiis & oscillis nostris fuerat pec-
catum. Gaudeto itaque, Cœlestis anima, hac peculiari
debitaque tibi laude, Canones tuos præ mille veterum
recentiumque Astronomorum, binorum luminarium na-
tutam & motum verum adsequi. De cæteris equidem
planetis haud desperabis, qui vagabundam & incertissi-
mam Lunam in numeros tuos felici invento coegisti. Va-
le, Charissime, & τὸ πατέρα τῶν πάντων, quod soles, venerare.

*Oxonii, postri-
die Eclipsæos.*

*Eclipsis Solis die secundo Julii St. Vet. A. D. 1684. Oxonii
observata, presentibus multis viris egregiis.*

*Digitis ob- Tempora Of-
curs, cum cillatoria a
suis decimis Cælo correctæ.*

		h		"	
		2	03	00	Initium Eclipsis
0	6	2	07	44	
1	0	2	10	44	
1	3	2	13	19	
1	6	2	15	44	
2	2	2	21	34	
2	6	2	23	44	
2	9	2	25	39	
3	5	2	29	54	
4	0	2	33	04	
4	4	2	36	34	
4	6	2	40	04	
5	0	2	43	14	
5	3	2	48	19	
5	6	2	50	09	Medium quasi solem fecit τὸ λελαργόν.
6	5	2	57	30	
6	7	2	59	14	
7	4	3	08	24	Obscuritas maxima.
7	1	3	11	09	
6	8	3	29	19	
6	7	3	31	39	
6	0	3	37	24	αὐτὸς ἐπὶ κέντρῳ τὸ σκότος.
5	7	3	39	29	
5	5	3	44	29	
5	0	3	47	59	
4	4	3	50	34	
3	9	3	53	54	
2	9	4	02	49	
2	5	4	04	39	
2	2	4	06	19	
2	0	4	07	54	
1	4	4	13	09	
1	0	4	15	04	
0	7	4	16	49	
0	3	4	19	39	
Finis		4	21	14	Finis Eclipsis.

Mr. Jacobs at Lisbon noted July 2. Stylo Vet.

The beginning of the *Eclipse* at 1. h. 30' exactly.

The ending at 4. h. 12'.

*Extract of the Minutes of the Dublin Society from
July 9th, to the 12. 1684.*

Mr. Ash and Mr Molyneux, though the day being much overcast, hindred them from taking any thing accurately, yet gave some account of their *Observations* viz. that toward the middle of the *Eclipse* having a short view of the *Sun*; they judg'd that about 8. *Digits* were cover'd: at the ending also having a faint view thereof; they assign'd its *end*, at 3. h. 56. p. m.

*Extract of a Letter of Mr. William Molyneux S. P. S.
of Dublin dat. Sept. 2. 1684.*

The same *Eclipse* was observed by one Mr. Osburn nigh *Tredagh* in this *Country* Lat. 53. 40'. *Initium* 1. h. 37'. 30'. *Finis* 3. h. 56'. 20'.

Casp. Bartholini Thom. F. de *Ductu Salivali hætenus non descripto, Observatio Anatomica.*

EO jam perventum est in Anatomæ studio, ut nec in Majorum placitis tuto acquiescere, nec illa sola admittere possimus, quæ novo se commendant titulo, sed quærendum est, potius prudens temperamentum, ut & hæc & illa commode jungamus. & ubique cavendum inprimis, ne à natura ipsa recedamus. Quin & non hic subsistendum, ubi substituerunt ante nos alii, sed progrediendum ulterius, ut, quæ adhuc dubia sunt, illustrentur, quæ latent, detegantur. Habent enim plurima Veteres, quæ exponenda sunt, sed cum defectu invenerunt alia Recentiores, quæ his addenda sunt, sed cum judicio & circumspecte; restant adhuc plura, quæ nobis ulteriori studio investiganda veniunt.

Et, ut alia taceam, certe fontes salivæ. & vasa illam ad cavitatem oris deducentia, non plane ignota fuisse videntur veteribus, licet saltem quasi per nebulam observata. Non tamen ideo sua laus detrahenda est Recentioribus, qui ulterius progressi, manifestius has glandulas descripserunt, & vasa salivalia

valia ab illis prodeuntia in lucem protraxerunt. Sed nec illi inter recentiores, qui multa quidem hac in re egerunt, omnia peregrisse videbuntur. Antiqui Medici, *Galenus, Haly Abbas, Avicenna & Isaacus*, qui quidem vasa salivæ nobis aliquo modo indigitasse videntur, obscura admodum illorum nobis reliquerunt vestigia. Descripserunt vero illa accuratius inter recentiores Anatomici Celeberrimi *Stenonius & Warthonus*, quorum insuper diligentia & hoc nostrum jam addimus Spicilegium.

Glandulæ omnes, quæ oris cavitati salivam subministrant, & ejusdem generis vasa excretoria in os emittunt, numero vasorum distincta accuratissime proponuntur à *Stenonio* in Observationibus Anatomicis de Glandulis oris. Quædam enim unico duntaxat excretorio vase præditæ sunt, quædam pluribus. Illa vasa, quæ numero plura, sed exigua, in oris cavitatem confluunt, propria sunt iis glandulis, quæ varie sparsæ reperiuntur in buccis, sub lingua, in palato & tonsillis. Vasa vero majora, quæ à glandulis conglomeratis unico prodeunt canali, hæcenus saltem duo utrinque innotuerunt, quorum primum superius est a Parotide conglomerata ortum & à *Stenonio* inventum atque descriptum: secundum vero inferius, cujus primam delineationem *Warthoni* diligentia debemus, quod à glandula maxillari inferiori provenit. Sed duobus illis hæcenus descriptis vasis tertium, ejusdem plane generis, addi debet, jam primum, quantum quidem ego scio, à me descriptum & delineatum, quodque inferius etiam dici meretur, quippe à sublinguali glandula ortum, *Warthoni* ductum comitatur, & sub lingua eodem quo Warthoniano, loco aperitur, ostio æque manifesto. Glandulam quidem, à qua tertium hoc vas originem repetit, describit *Stenonius* de Gland. Oris, & sublingualis nominat, sed illi immerito plura & angusta vasa excretoria tribuit, quæ huic glandulæ adjacentibus minutis aliis & ab ipsa revera distinctis glandularum glomeraminibus jure debentur, quia scilicet verum hoc sublingualis glandulæ vas excretorium nondum ipsi fuit perspectum. Est autem sublingualis hæc glandula, quæ tertium illum promit ductum, ex illarum genere, quæ conglomeratæ, recepta hæcenus distinctione Sylviana, nominantur, sita utrinque ad latera linguæ, & illi adjacent dispersæ nonnullæ glandulæ minutæ, quæ angusta illa excretoria vasa obtinent, de quibus in sublinguali-um descriptione *Stenonius*, & quæ à sublinguali hac glandula oriri credidit, ubi ita: *Ejusdem generis cum proxime præcedentibus sunt (sc. sublinguales glandulæ) nisi quod vasa excretoria obtinuerint, non quidem breviora, sed angustiora. Oriuntur intra ipsam exiguis rivulis, & hinc sibi invicem parallela, à lingua versus gingivas recedunt, ubi ad digitum fere à dentibus distantiam, vix conspicuis, nisi premantur, ostiis, per tunicam*

biant. Nulla ostiis, nisi ad aliquod intervallum, protuberantia adjunt, sed, ut in buccæ vasis dictum, ubicunque vascula prædicta tunicam penetrant, ibi equalis est & plana. Recte quidem hic describuntur illi ductus, qui à parvulis glandulis ad latera sublingualium fitis oriuntur; at habet ipsa sublingualis glandula peculiarem alium Ductum, nondum descriptum sed mihi primo observatum Anno 1642. d. 13. Martii. Etenim cum in capite Vitulino extremitate styli inquirerem & prosequerer ductum à glandula maxillari inferiori progredientem, à *Warthono* descriptum, forte in alium ductum adactus stylus aperuit ea quæ mihi ante ignota erant. Credideram enim eundem ductum me ad Warthonianam glandulam perducturum, & ecce eo loco, circa mediam scilicet linguæ longitudinem, ubi *Warthonus* ductum suum salivalem à linguæ lateribus, nimirum in inferiore ejus parte, cute & pinguedine glandulosa tegi dicit ferebatur hic ductus ad aliam glandulam e conglomeratarum genere, quæ proxime accumbit iis glandulis, à quibus oriuntur ductus illi salivales, qui sublingualium nomine describuntur à *Stenonio*. Etenim illa glandula (quæ in nonnullis animalibus glandulæ maxillari inferiori propius adjacet, & majuscula est; in aliis vero minor & magis versus extremitatem maxillæ inferioris sita) uti ejusdem plane structuræ est, ac maxillaris illa Warthoniana inferior, ita etiam simile plane vas excretorium habet, satis conspicuum, cujus ductus laterales ab omnibus glandulæ glomeraminibus orti, in medio communem & satis capacem truncum habent, qui ductu recto comitatur illum alterum à *Warthono* descriptum & intra gingivas in maxillæ inferioris extremitate, inter papillas quasdam compressas & rigidas, maxillæ pertinaciter adhærentes, in os aperitur.

Talis primo mihi tunc temporis obtulit se Ductus ille cum sua glandula in Vitulini capitis examine. Cujus rei testes Amplissimos advocare possum Celeberrimos facultatis nostræ Medicos & Collegas meos D. D. *Olaum Borrichium* & D. *Oligerrum Jacobæum*, quorum judicio inventum hunc peculiarem ductum statim subjeci. Confirmata deinde sæpius est hæc observatio in aliis animalibus. In ove, in ipsis illis papillis, sub lingua in inferiori maxilla conspicuis, terminatur extremitas hujus ductus, juxta quam etiam simili modo in eadem papilla hiat ostium ductus Warthoniani. In Urso utrinque prope linguæ frænulum suâ cujuslibet ductus ostium papillâ eminet. In Leæna, quam nuper indulgentia Augustissimi Regis nostri Theatro Anatomico concessam habuimus, itidem ad linguæ frænulum exeunt quidem utriusque ductus ostia, sed ita ut sibi quasi peculiare quoddam frænulum habeant à tunica oris interiori efformatum. Ipsa autem glandula cui originem debet ductus noster, in principe hoc Animalium, ma-

ior est & oblongiuscula, atque altera sui parte pertingens usque ad glandulam Warthonianam, atque uti variis constat glandularum glomeraminibus, ita ex iis provenientes variæ ramificationes emittuntur ad communem ductum, qui ex minoribus aliis extra glandulam coalescit, & recto tramite Warthonianum ad exitum comitatur. Similem etiam distributionem & exitum eorundem vasorum, atque eodem fere modo fitas & confirmatas glandulas nuper deprehendimus in lynce. Et ut singula fiant illustriora, cum plures alias ossemus, addimus saltem in fine hujus observationis, figuras ex Anatomie Leænæ desumptas, progressum atque exitum Ductus hujus indicantes.

An alii similia ante me observaverint, ignorare cogor, cum nihil unquam hac de re ab ullo Anatomicorum scriptum meminerim hactenus; Nec tale quid unquam de duplici ductu salivali interiori à distinctis glandulis oriundo, & distinctis ostiis in oris cavitatem aperto, legerim apud Recentiores. Nam Warthonum huc trahere invitum nequaquam possumus, qui Tractat. de Glandulis Cap. XXI, de Maxillaribus, ubi inferiorem glandulam una cum ductu Salivali descripsit, adjicit: *In Equo circa mediam linguæ longitudinem utrinque aliæ glandula conspicua in ductum Salivalem sese exonerantes occurrunt, de quibus forsitan uberius dicetur post hac, cum earum varietates in cæteris animalibus examinatæ fuerint.* Observavit quidem, ut videtur, in unico hoc capite Equino glandulam illam sublingualem à qua oritur hic ductus; sed nunquam duplicem canalem salivæ dicatum & à distincta glandula oriundum agnovit, qui simplicis saltem ductus inferioris mentionem ubique facit. Nec sane ex veteribus accuratam Ductuum salivalium notitiam haurire possumus, licet reperiantur inter Antiquos Medicos nonnulli, qui obscurum aliquod illorum nobis dedisse videntur indicium. Et Galenus quidem Lib. XI de Usu Part. Cap. X. generaliter saltem loquitur de meatibus, qui ex glandulis linguæ per obliquas partes atque inferiores humorem pituitosum in ipsam eructant, linguam ipsam atque inferiora, lateraque & omnia quæ in oris sunt circum humectantes. Distinctius Avicenna non solum glandulas & ductus, sed & vasorum ostia indicat sub lingua, Can. 3. Lib. fen. 6. tr. 1. c. 1. ubi ita ex versione Gerard. Cremonensis: *Sub ea [Lingua] sunt duo ostia, quæ ambo ingreditur stilus, & sunt fontes salivæ, quæ ad carnem perveniunt glandulosam quæ est in radice ejus, & nominantur generativæ salivæ. Et ipsi duo fontes nominantur hauritoria salivæ conservantes vocem linguæ.* Nec aliter Isaac Medicus, filius adoptivus Salomonis Regis Arabiæ, Lib. III. Theor. Cap. XVII. *In ligamentorum lateribus quædam venæ sunt, quæ salivam semper linguæ subministrant, hæ ab initio linguæ incipiunt in modum arteriarum, à quibus emanat humectatio phlegmatica quæ vocatur saliva. Istæ a Medicis vocantur habitatio salivæ.* Initium

Initium linguae unde exeunt hae venae, caro est glandulosa atque alba, ipsius saliva generativa, quae adjuvat cum salivam ab illis venis recipiat, unde humectat linguam atque buccam. In eundem modum Haly Abba, Lib. 3. Theor. Cap. 16. de Lingua: Ab horum lateribus ligamentorum ora venarum sunt, a quibus saliva decurrit, earumque a linguae radicibus principium in arteriarum figura, per quas humiditas decurrit phlegmatica quae saliva vocatur, Dicunturque ora earum venarum saliva habitacula. Est autem in radice linguae, loco quo hae oriuntur venae, glandulosa caro, alba, quae generatrix dicitur saliva. Ejusque est utilitas ut humiditatem suscipiat phlegmaticam, quae ad eam ab illis egreditur venis, quas habitacula saliva diximus. Qui penitus hae verba Antiquorum Medicorum excusserit, deprehendet fortasse aliquod apud illos vestigium Ductuum Salivalem, qui jam demum à Recentioribus ad lucem novam revocati sunt. Erit ergo Antiquitati hae reverentia, quod & veteres aliquid in hoc foro viderint, licet nec distinctum, nec accuratum, sed saltem ad cognitionem Anatomicam illorum temporum accommodatum. Recentioribus vero non ideo minor relinquetur gloria, quod illas Veterum observationes reddiderint accuratiores, & hae vasa salivalia, licet à Majoribus obiter indicata, tamen hactenus plane ignota, in medium protraxerint, & eorum veram notitiam orbi restituerint. Mihi certe, qui nec Antiquos hac in parte ante inventionem Ductus jam descripti consului, nec à Recentioribus ullam accepi lucem in ejusdem investigatione, sufficit Naturam ut in se est hic aperuisse, quam scio omnibus patere, licet non omnes eandem pari vel sagacitate sollicitent, vel felicitate scrutentur, cum interdum illa etiam circumspiciendorum sollicitissimas effugiant curas, quae forte obvia se fiunt nihil minus cogitanti.

Atque ita nova accessione jam auctus est numerus ductuum Salivalem; & glandularum Sublingualium usus hoc excretorio vase illustrior redditus. Et certe illa quae de Pancreatis ductu ejusque succo Recentiorum diligentia invenit, viam aperuerunt reliquarum glandularum & vasis inveniendis & usui agnoscendo. Nec enim amplius habenda est Glandula, ubicunque in corpore nostro reperiunda, pro parte corporis vel otiosa, vel superfluis humoribus destinata, sed potius quasi pro cribro quodam fecernente a sanguine humorem conservationi Individui maxime necessarium. Nimirum cum per arterias ad singulas corporis partes deferatur sanguis, & antequam per vasa capillaria venarum ab iisdem redeat, varias in nonnullis partibus deponat particulas, quae per vasa peculiaria (excretoria communiter dicta Anatomicis) excluduntur, proprie cribri nomen meretur illa circumfusa materia, quae inter capillaria vasa arteriarum & extrema oscula vasorum excretoriorum intermedia est, quaeque efficit, ut transitus fiat

non totius sanguineæ massæ, sed quarundam saltem ex ea secretarum partium, diciturque alias parenchyma, affusio, vel caro viscerum. Ita in sanguine post diversorum humorum in se mutuam actionem diversi generis particulae, à tota massa separatae, in singulis cribris sibi convenientes meatus inveniunt. Et qui bene hanc generalem cribri descriptionem animo comprehendit, simul intelliget viscerum omnium, quæ vase excretorio prædita sunt, conformationem. Talia autem sunt illa viscera, quæ vulgo Glandulae vocantur, quæque recepta hæcenus distinctione dividi solent, ratione conformationis, in Conglobatas & Conglomeratas.

Conglobatae glandulae illae dicuntur, quæ æqualem habent superficiem, ex una quasi sibi continuata substantia conflatae, & quæ excretoria habent ejus generis Lymphatica vasa, quæ à b. m. Parente meo quondam inventa & descripta sunt. Illorum autem lymphaticorum per glandulas has conglobatas talis observatur distributio. Quaedam à primis suis fontibus in glandularum superficiem sparguntur, quaedam à concava parte unius glandulae in alterius convexam partem pergunt, quaedam iterum ab earundem glandularum parte concava ad locum insertionis in venam cavam exporriguntur, idque vel immediate, vel per intermedium Thoracicum ductum. Ita omnia hæc lymphatica, quæ à sanguine secretum in glandulis conglobatis humorem excernunt, eundem in sanguinem iterum, facto quasi circulo, reducant. Reperiuntur tales glandulae in mesenterio inter vasa excipientia chylum ab intestinis & Receptaculi lumbaris radices circa venam portam; inter lymphatica hepatis & ejusdem Receptaculi radices; in lumbis, inguinibus, circa pulmones, in maxillis in collo, supra fauces, sub alis, in omento alibique. Memini me quondam in Nosocomio Florentino in foeminino cadavere glandulas duas conglobatas cum suis lymphaticis insignis atque notabilis magnitudinis inter cutem & musculos abdominis in ilio sinistro in pinguedine reperisse. In alio hydropicæ cadavere ibidem à me aperto, abdominis cavitas aqua copiosa repleta erat, glandulae vero omnes, quæ ubique latitantes præter solitum multiplicatae mihi videbantur, schirrosæ & materia purulenta refertæ. Mirari subiit insolitum glandularum numerum & magnitudinem præternaturalem. Et quod ad hanc attinet, illam materiae contentæ, in hoc affectu ita glandulas distendenti, attribui. De insolito vero glandularum numero dubium habui, an ullæ in corpore glandulae, non ibi ante existentes, novæ procreentur, an vero antea parvæ solum & quasi miliares latentes, ita interdum augeantur, ut oculis clarius paterent, quemadmodum de mammarum glandulis certum est, quæ in omnibus dantur, sed in aliis conspectiores sunt. Certe

Certe conglobatarum vera notitia non parum infer-
 vit affectui difficili explicando, nimirum scrophulis, & iis
 quæ circa scrophulas observantur. Non raro enim vi-
 dere contingit ingentes sacculos intra conglobatas gland-
 ulas contentos, plenos materia vel flavescente vel gypse-
 a; adeoque facile agnoscitur crassiores lymphæ partes,
 dum per glandulas cribrantur, nec transitum patentem
 inveniunt, sensim ibi collectas sacculos formare. Quod
 vero dicunt de consensu glandularum colli & mesenterii,
 dum ut plurimum existentibus in collo scrophulis similes
 etiam in mesenterio reperiuntur, non fit per communica-
 tionem quandam immediatam inter collum & mesente-
 rium; aut per occultas sympathias; sed idem sanguis in
 omnibus ejusdem naturæ glandulis ejusdem generis con-
 tenta deponit. Unde sequitur, quod materia existente
 pauca, vel una tantum afficiatur glandula, vel multæ si-
 mul, sed obscure: materia autem existente copiosa, plures
 simul glandulæ eadem repleantur; atque mutata deinde
 sanguinis natura per liquores resolventes, resoluta in
 glandulis dicta materia, humores evanescant.

Conglomeratæ glandulæ ex variis quasi partibus & mi-
 noribus glandulis, cum aliqua superficiei inæqualitate,
 constantes, sola lymphatica evehencia habent, sed alteri-
 us plane generis ac priora illa, quippe quæ in peculiare
 cavitates liquorem, à sanguine in glandulis secretum, im-
 mediate deponunt; ut salivales in oris cavitatem, & pan-
 creaticæ in intestinum duodenum. Atque hujus gene-
 ris glandulæ omnes, quarum saltem vasa excretoria ha-
 ctenus nota sunt, suppeditant humorem, quo mediante
 assumptorum prima resolutio instituitur. Unde in ore
 præcipue & per totum ductum viæ alimentorum tales
 glandulæ vel parvulæ varie sparsæ, vel in corpora insignia
 coagmentatæ reperiuntur. Et si quæ videantur extra ca-
 nalem alimentorum sitæ, ut glandulæ oculorum & nari-
 um, tamen ubi illarum humor palpebras inunxerit & in
 nares delapsus (per vasa dicta olim puncta lachrymalia)
 cum narium humore particularum odoriferarum percep-
 tionem servierit, in canalem alimentorum (per viam à na-
 ribus

ribus in os patentem) tandem derivatur, quo etiam ex naribus effluens humor deducitur.

Ipsam glandularum structuram si attingamus, utique multa nobis imponere specie carnis, communiter ita dictæ, deprehendemus, quæ revera sunt vasa excretoria, uti contingit in Renibus, monente *Malpighio*. Etenim quemadmodum in Renibus peculiaris illius substantiæ, quam pro carne habuerunt antiqui, maxima pars constat ex minutis canaliculis & meatibus, per quos urina in pelvim affluit, & quibus circumpositum est verum cribrum glandulosum pro secernenda urina; Ita etiam magna pars illius substantiæ, quam quasi peculiarem carnem vel parenchyma in glandulis consideramus, componitur ex variis tubulorum glomeraminibus & vasis excretoriis lymphaticis, nervis, vasis sanguineis, addo & fibris carnis, quibus non solum investiuntur glandulæ, sed & eas substantiæ suæ intertextas habent. Atque ex hoc interioris glandularum structuræ examine patet vehementer eos falli, qui in partium descriptione saltem de externa figura solliciti sunt, nec satis attendunt ad minimam & intimam illam partium structuram, per quam omnes in corpore nostro Natura exercet operationes.

Explicatio Figurarum ex Anatome Leænæ.

PRIMA FIGURA exprimit glandulam maxillarem inferiorem A, cum ductu salivali Warthoniano B, B, simulque vicinam glandulam sublingualem C, cum ductu suo salivali D, jam primum a nobis descripto, cujus variæ ramificationes per totam glandulam dispersæ conspiciuntur.

SECUNDA FIGURA indicat duo utrinque ostia ductuum salivalium inferiorum. Warthoniani nempe & nostri, quorum locum sub lingua designant extremitates filorum a a a a, per dicta ostia exeuntium sub lingua b, quæ hic paulisper revulsa cernitur a maxilla inferiori c, ut singula rectius pateant.

Essays of natural Experiments made in the Academy del Cimento under the Protection of the most Serene Prince Leopold of Tuscany. English'd by the ingenious Richard Waller Esq; Fellow of the Royal Society.

THis work was published in *Italian* in the year 1667. and contains several curious *Experiments* made in the Academy del Cimento, at Florence: the *Italian* Author thought fit to prefix a *Preface* elegantly discovering the design of the *Academy*, to advance real knowledge, their Ingenuity, and Candour in communicating their *Experiments*, and their obligations to the great Duke Ferdinand of Tuscany, Father to the present Duke Cosmo.

1. The *Experiments* are couch'd under 10 heads, treating of several *Subjects*. It were improper in this place to give a large account of each *Particular*; but in short: Having described some of their *Instruments*, as *Thermometers* (of which they seem to bid fairest for the *invention*; the first having been brought from *Florence*, and shewn here, tho they were reduced to a Standard, and received their *perfection* hence) the *Pendulum*, and other *instruments*, they come then to their first head, the *Airs pressure*, where most of the known *Mercurial Experiments* are tryed, and confirmed, *Objections* answer'd, &c. with several *Experiments* made in *vacuo*, upon as well animate, as inanimate Bodys. Amongst the rest is observable an *Experiment* of *Sound*; which may be worth repeating, viz. that an *Organ Pipe* sounded in *vacuo*, speaks with little, or no difference, the thin *Æther* it seemes being capable of causing it. Another *Experiment* is related of a small *Fish* that survived the *Wrack* of the *vacuum*, but was thereby so far disabled; that he could never after raise himselfe in the water, but had the *Serpents Curse* of creeping on his Belly in the Mud.

2. In their second Head of *Freezing* they are very curious in examining the *Expansion*, Force, and Procedure of

of freezing, whereof they have set down several very accurate Tables containing the gradual increase of *Bulke*, and particular time of every change happening in divers *Fluids*, these *Experiments* were made by an Artificial application of *Salt*, and *Snow* to the outside of the vessels. There are likewise many Tryals of *Freezing* naturally by the simple cold of the air. To these are added some *Experiments* about the alteration of the capacity of vessels by *Heat* and *Cold*.

3. *Experiments* to shew *Water* incapable of Compression.

4. Against *Positive Levity*.

5. *Magnetical Experiments*.

6. They treat of *Electric Bodys*; which are so, which not, where many *Experiments* are tryed, chiefly with *Amber*.

7. About the change of *Colours* of *Fluids* by the mixture of other *fluids*; where 'tis observable that water still'd in *Lead* inturbidates all *Spring*, *River*, and *Bath* waters.

8. About the Motion of *Sounds* made with several *Canon*, and *Musket* shot.

9. Of *Projected Bodys*, their motion.

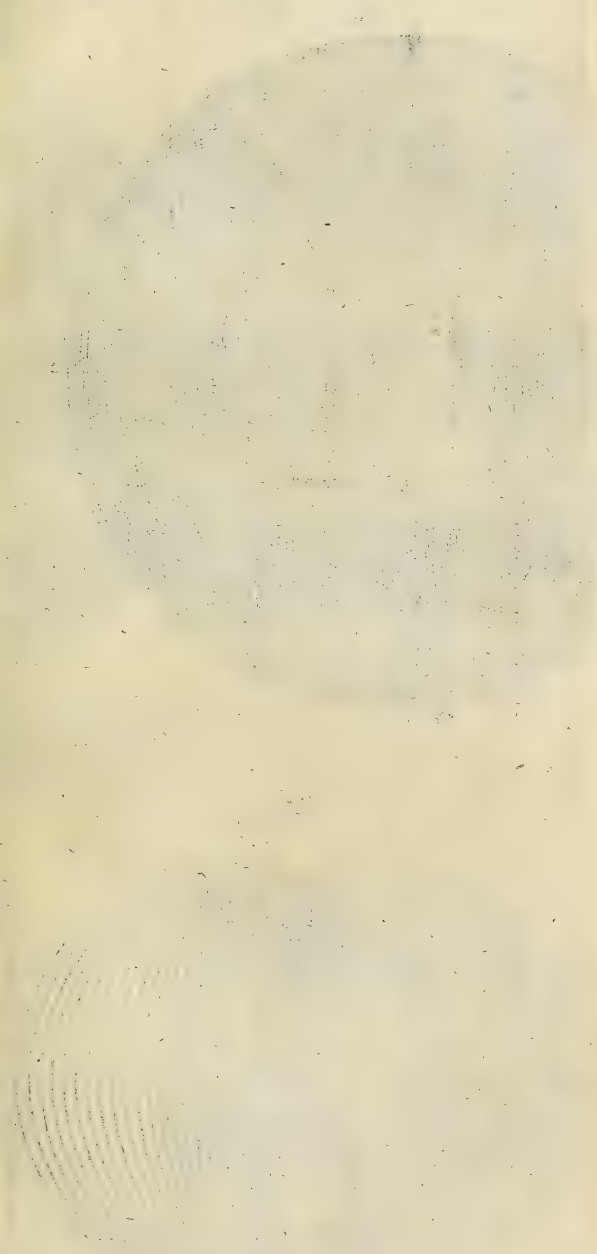
The 10th, contains a Miscellany of *Experiments* not reducible to any of the former heads; as the Comparative weight of *air*, and *water*, Difference of weight of Bodys hot, and cold. Force of heat in *Rarefaction*, which was indeed very great, breaking a stone Pavement &c. Of *Glass* whether penetrable: of *Light*, and its quick motion: of *Burning-Glasses*: of Bodys affording *Light* when broken to pieces, *Experiments* touching the Digestion of *Animals*, which seemes to be by attrition; Grinding to Powder all bodys of what solidity soever.

So much shall suffice for a slight view of the work, which in most if not all the *Experiments* is very nice, curious, and faithful: but to satisfy those that desire a fuller information I recommend the *Book* it self as very well worth the Perusal, and by this *Translation* easy to be procured.

O X F O R D,

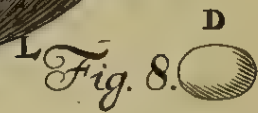
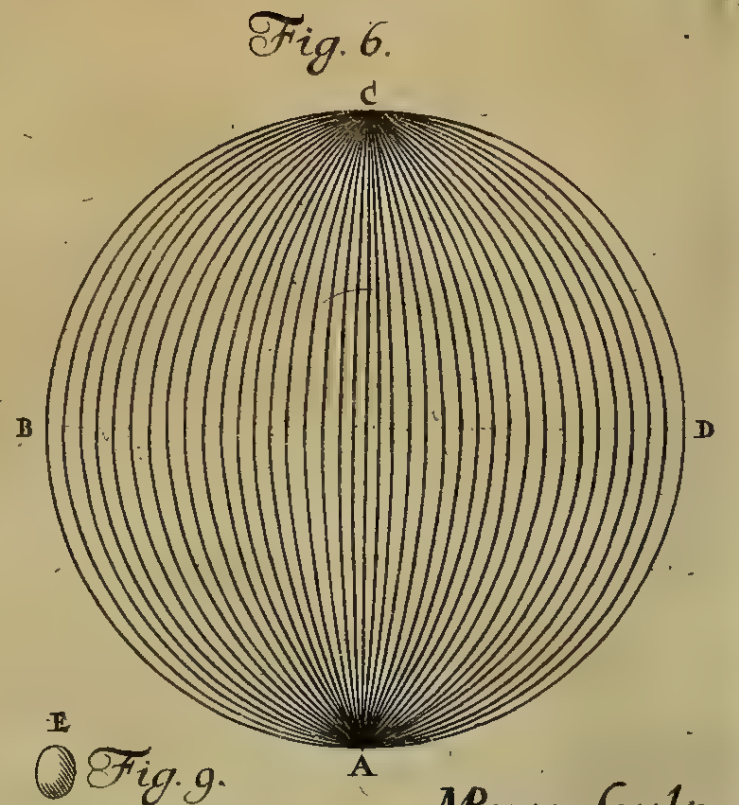
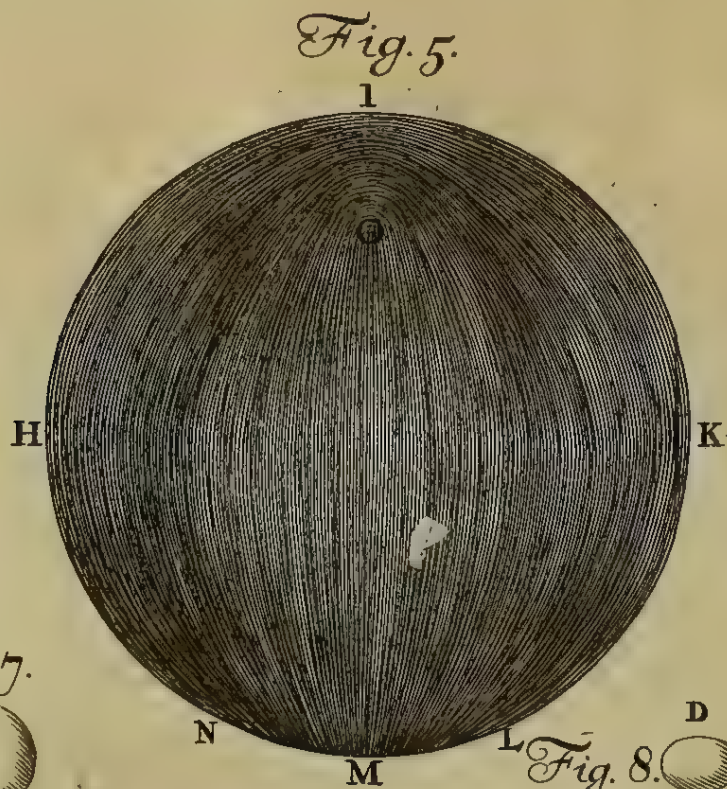
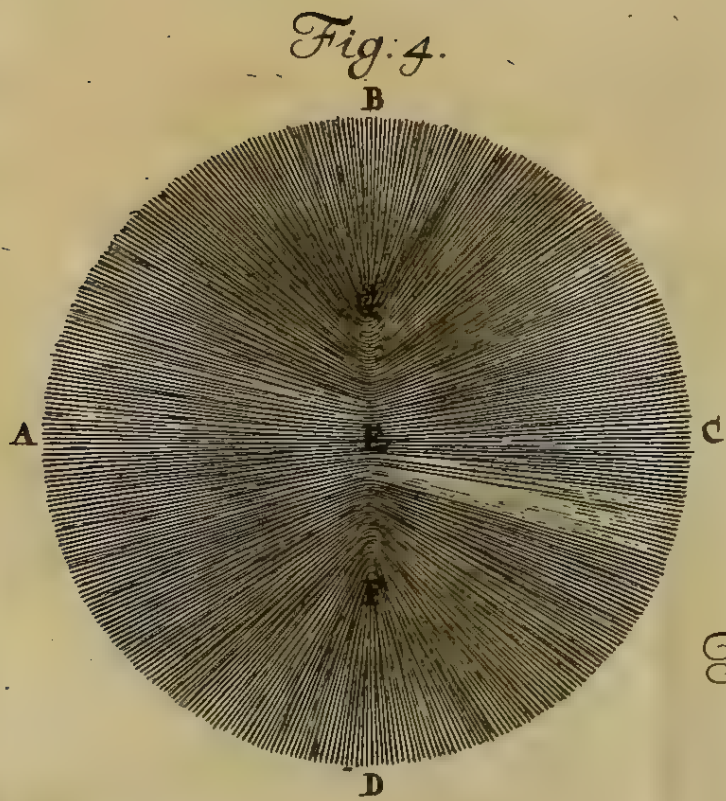
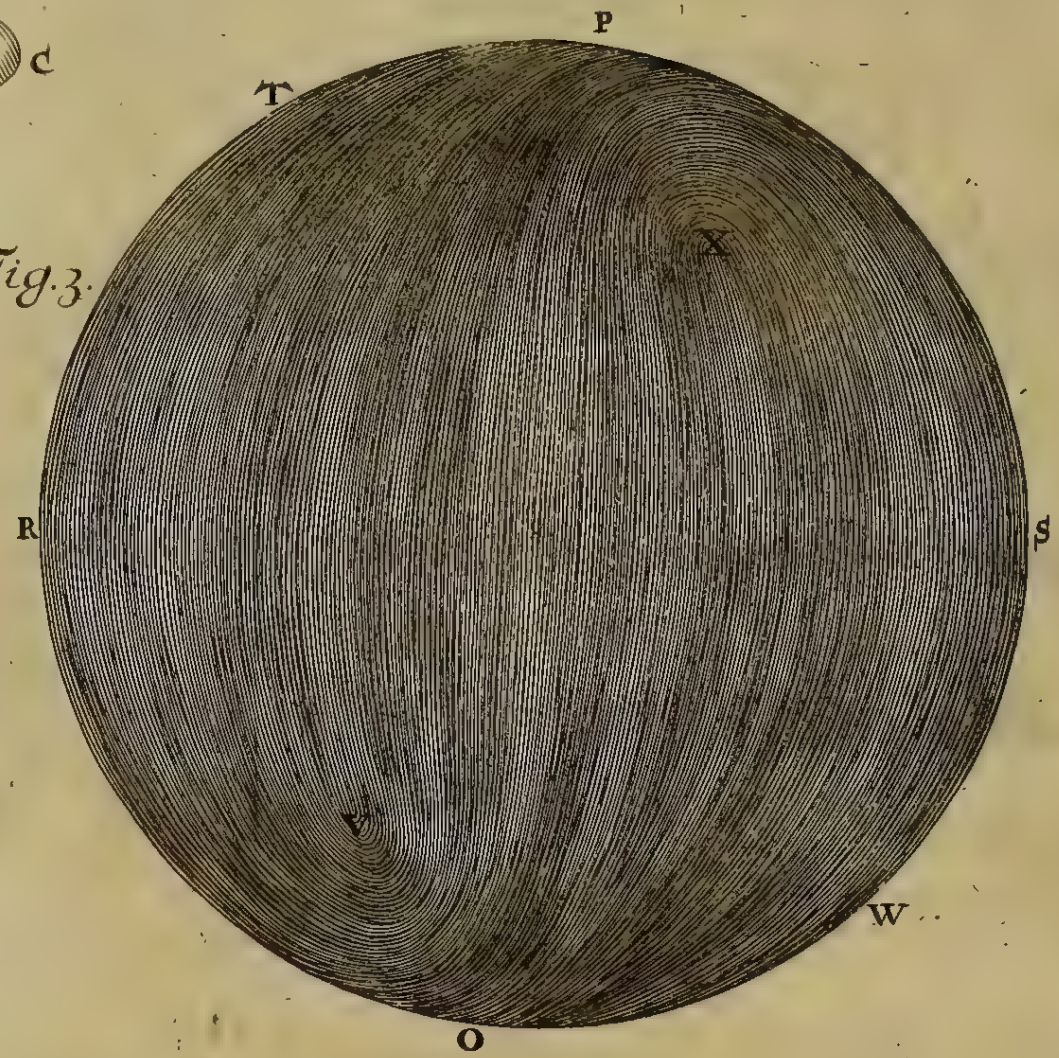
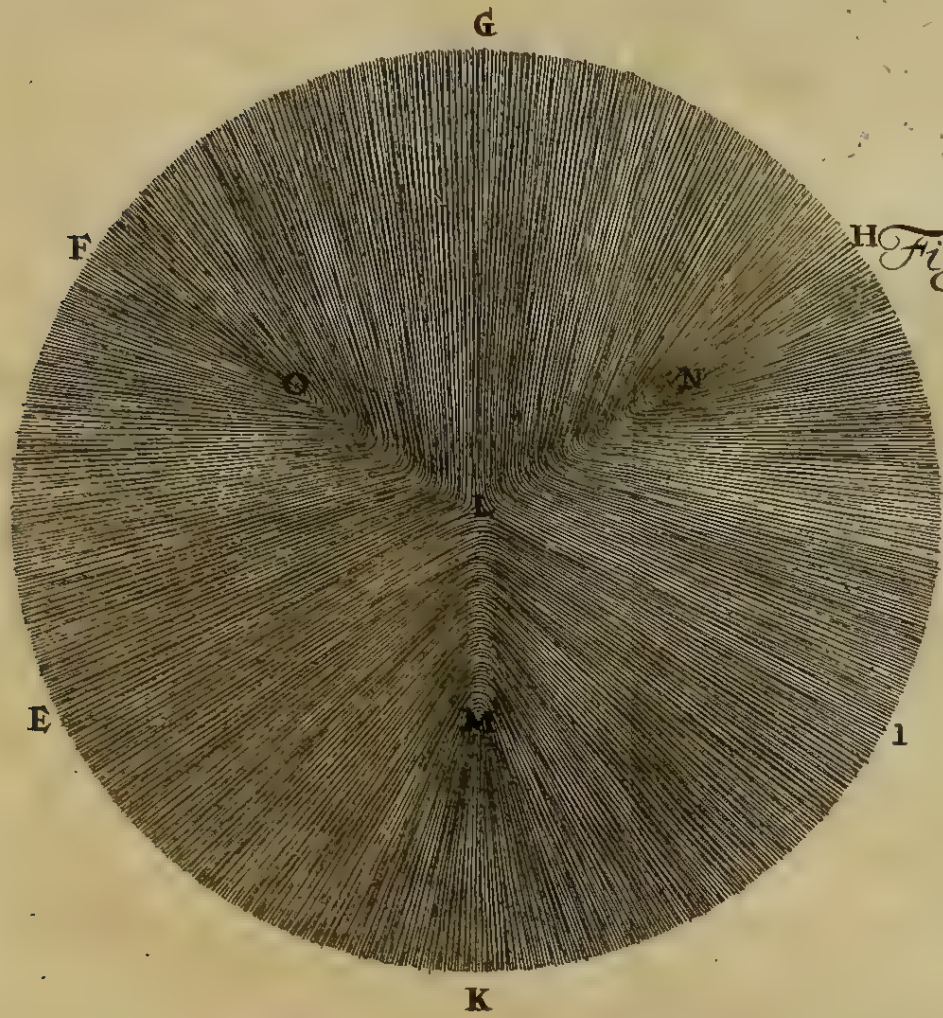
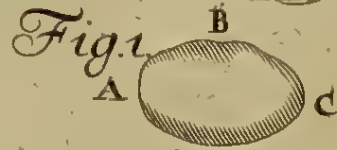
Printed at the *THEATER*, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON. 1684.

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Philosoph. Transact. Number, 165.



M. Burg. sculp.

PHILOSOPHICAL

TRANSACTIONS.

Novemb. 20. 1684.

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- An account of a Book. SCOTIA ILLUSTRATA, sive Prodomus Historiæ naturalis, &c. Authore Roberto Sibbaldo M. D. Equite Aurato, Medico & Geographo Regio, & Regii Medicorum Collegii apud Ebinburgum Socio. Edinburgi in fol. 1684.*

1. *A Letter from the learned Mr John Flamsteed Astron. Reg. concerning the Eclipses of Jupiters Satellit's for the year following 1685. with a Catalogue of them, and informations concerning its use.*

Eclipses *Comitum Jovialium* ubique Terrarum Anno labente 1684. visibiles, Actis vestris *Philosophicis* Mensis *Decembris* Anni anteaacti 1683. Numero 154. editi, è Novis motuum *Tabulis* supputatas, quas è propriis *Observationibus* cum antecedentibus Clariss. Hodiernæ, *Cassini, Rookii, & Townleii* collatis deduxeram. Observatis exinde nonnullis è prævisis cujuscunque *Satellit'is* Eclipsibus, *Tabulas* raro duo temporis minuta horaria in phasibus *Primi* aut *Quarti* à Calculo discrepare comperi; in defectibus autem *Tertii & Secundi Satellit'is*, errores 5 vel 7 minutorum horæ prodire, & aliquando sed rarius duplo majores, unde innotuit, illorum Motus satis esse æquabiles, horum vero inæqualitatibus exiguis implicatos, quibus investigandis longiore opus esset experientia. Comperto hoc *Tabularum* cum cælis consensu, novam exinde Eclipsium *Catalogum* supputavi, in annum 1685, eumque vobis maturè edendum transmittito, illorum in gratiam, qui vel *Satellitum* Motibus accuratius restituendis mecum invigilant, vel difsitorum locorum distantias *Meridianas* cœlitus factis observationibus deducere cupiunt; cui negotio commodiora dari posse phænomena vix aliquis credet, si vel debite instructus eclipsis alicujus observationem tentet, vel observandi facilitatem, æquabilitatem cum velocitate motuum *Comitum Jovialium*, aut eclipsium frequentiam secum serio perpendet. Harum, quæ in *Nostro Horizonte* visibiles sunt, *Asterismo* [*] in *Catalogo* notantur; Reliquæ nobis inconspicuæ iis in locis observandæ venient,

ubi

ubi tum temporis, sole infra *Horizontem* versante, *Jupiter* supra eum existit; at quibus limitibus ea in orbe nostro loca clauduntur, facile ope *Ephemeridum* vulgarium & *Globi* terrestris cognoscatur, Methodo sequenti.

Ad datum tempus cujuscunque *Immerſionis* aut *Emerſionis*, promatur ab *Ephemeride* locus verus *Solis*, cum loco *Jovis*, & latitudine Geocentrica; inde utriusque *Ascensionis recta* deducenda est, cum declinatione ab *Equatore*; vel ope *Tabularum* Primi Mobilis, vel, si desint, ipsius *Globi*.

Sistatur tunc *Londinum* (cujus ferè ad *Meridianum* tempora Eclipsium supputantur) sub Meridiano *Globi* æneo, & notato *Æquatoris* gradu simul ipsum transeunte, auferatur inde (addito prius si opus est circulo) tempus eclipsis post Meridiem in gradus eorumque partes conversum, Arcus reliquus Longitudinem ostendit locorum omnium, quibus illa contigit satellitis Eclipsis, Sole Meridianum transeunte; quam propterea *Meridianam Eclipsis Longitudinem* appello.

Volvatur hæc *Meridiana Longitudo* ad Meridianum *Globi*, & elevato supra horizontem ejus Polo Soli propiore, quantum est ipsius declinatio, detentoque in ea positione immoto Globo, si sit ☿ in consequentia Solis, ducatur linea ipsum supra per finitorem (vulgo) orientalem, isthæc loca ea omnia designabit quibus tum temporis Sol occidit: Quod si ☿ sit in antecedentia Solis, scribatur linea per horizontem occidentalem, loca transcurrer quibus Sol tunc oritur.

Existente ☿ in consequentia Solis, *Meridiana Longitudini* addatur differentia Ascensionum rectarum Solis & Jovis, Summæ huic respondens *Æquatoris* Gradus sistatur sub Meridiano *Globi*, & exerto supra finitorem Polo ☿i proximo, quantum ille ab *Æquatore* distat, manente immoto Globo, scribatur linea ipsum supra per horizontem ortivum; spatium hanc inter & lineam occasuum Solis anteductam interceptum, loca ea omnia

comprehendet, quibus Eclipsis observabilis est ab occasu Solis ad occasum Jovis.

Quod si φ in antecedentia Solis sit, à dicta *Meridiana Longitudine* auferatur differentia Ascensionum rectarum φ s & $\odot$ s, sistaturque sub Meridiano Globi, Æquatoris gradus Arcui residuo respondens; tunc exerto ab horizonte Polo φ i proximo, quantum ipse ab Æquatore declinat, & fixo in ea positione Globo, ducatur linea ipsum supra per finitorem occidentalem, spatium hac & linea exortuum Solis anteducta inclusum, loca ea omnia complectitur, quibus eclipsis videnda erit ab exortu φ i ad exortum Solis.

Plura non addo quoniam hæc Cœlorum peritos monuisse sufficiant, videant alii quæ de hisce phænomenis fusc scripsi sermone Anglicano in Præfatione ad Catalogum Anni labentis Actis vestris Phil. editum Numero 154. Tu interea vale. Grenovici scripsi Octobris 28. 1684.

Catalogus Ecliptium Comitum Jovialium ubique Terrarum Anno Insequen-
te 1685. Visibilium, tempora Ingressuum illorum in Jovis Umbra,
aut ab ea Emerfionum, sub Meridiano Grenoviano apparentia, exhi-
bens, è Novis motuum Tabulis suppurata; à Jo. Flamsteedio Math. Reg.
& R. S. S.

Jan.			S P			Febr.			Martii			Aprilis		
d	h					d	h		d	h		d	h	
1	21	29	1	1		1	6	34	2	1		1	7	2
2	10	13	3	1		2	17	51	1	*	1	16	56	2
	12	58		*	e	4	12	20	1	*	1	3	1	30
3	15	57	1	*	1		19	51	2	:	1	4	19	59
	20	23	2	1		6	6	49	1	1		5	6	24
5	10	24	1	1		7	5	54	3	1		6	14	28
7	4	52	1	1		8	1	17	1	1		7	21	51
	9	39	2	1			9	9	2	1		8	8	57
8	23	20	1	1		9	19	46	1	1			19	33
9	14	8		*	1	11	14	14	1	*	1	10	03	26
	16	53	3	*	e		22	26	2	1		11	21	55
10	17	48	1	*	1	13	8	43	1	1		12	8	51
	22	55	2	1		14	9	53	3	*	1	13	16	24
12	12	15	1	1		15	3	11	1	1		15	1	51
14	6	43	1	1			11	44	2	*	1		10	53
	12	11	2	1		16	21	40	1	:	1		22	10
16	1	11	1	1		18	16	9	1	*	1	17	5	22
	18	3		*	1	19	1	2	2	1		18	23	51
	20	47	3	e		20	10	37	1	*	1	19	11	28
17	19	39	1	1		21	13	51	3	*	1	20	18	20
18	1	27	2	1		22	5	6	1	1		22	5	51
19	14	7	1	*	1		14	20	2	*	1		12	49
21	8	35	1	1		23	23	35	1	1		23	0	47
	14	44	2	*	1	25	18	4	1	*	1	24	7	18
23	3	03	1	1		26	3	37	2	1		26	14	6
	21	59		1		27	12	32	1	*	1	27	0	0
24	0	43	3	e		28	17	51	3	*	1	& Z		
	21	31	1	1								27	22	30
25	4	0	2	1								29	12	32
26	15	59	1	*	1								16	59
28	10	27	1	1								30	6	4
	17	17	2	*	1							31	11	28
30	4	55	1	1										
31	1	57		1										
	4	40	3	e										
23	24		1	1										

Mai			Junii			Juli			Augusti		
d	b		d	b		d	b		d	b	
1:	5:	48 2 e	1:	10:	13 1* e	1	12	17 1 e	1	15	28 2 e
2:	8:	8 1* e		21	44 3 i	3	6	45 1 e	2	8	55 1* e
4	2:	37 1 e	2	0	21 3 e	4	5	3 2: e	4	3	24 1 e
	8	29 3* e		5	26 2 e	5	1	14 1 e	5	4	47 2 e
	19:	6 2 e	3	4	42 1 e	6	19	43 1 e		12	8 3 e
5	21	6 1 e	4	23	10 1 e	7	17	34 3 i		21	53 1 e
7	15	34 1 e	5	18	44 2 e		18	20 2 e	7	16:	22 1 e
8	8	24 2* e	6	17	38 1 e		20	10 3 e	8	18	5 2 e
9	10	3 1* e	8	12	7 1* e	8	14	11 1 e	9	10	51 1 e
11	4	31 1 e	9	1	42 3 i	10	8	40 1* e	11	5	21 1 e
	12	28 3* e		4	19 3 e	11	7	39 2 e	12	7	24 2* e
	21	41 2 e		8	1 2 e	12	3	9 1 e		16:	09 3 e
12	23	0 1 e	10	6	35 1 e	13	21	37 1 e		23:	50 1 e
14	17	29 1 e	12	1	4 1 e	14	20	57 2 e	14	18	19 1 e
15	10	59 2* e		21	18 2 e		21	33 3 i	15	20	43 2 e
16	11	57 1* e	13	19	32 1 e	15	0:	9 3 e	16	12:	48 1 e
18	6	26 1 e	15	14	0 1 e		16	06 1 e	18	07	17 1* e
	16	26 3 e	16	5	39 3 i	17	10	35 1 e	19	10	2 2 e
19	0	17 2 e		8	17 3* e	18	10	15 2 e		20	10 3 e
20	0	54 1 e		10	36 2* e	19	05	4 1 e	20	1	47 1 e
21	19	23 1 e	17	8	29 1 e	20	23	32 1 e	21	20:	16 1 e
22	13	34 2* e	19	2	57 1 e	21	23	33 2 e	22	23	21 2 e
23	13	51 1* e		23	53 2 e	22	1	32 3 i	23	14	45 1 e
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	17	46 3 i	22	15	54 1 e		18	01 1 e	26	12	40 2 e
	20	23 e	23	9	38 3 i	24	12	30 1 e	27	0	11 3 e
26	2	52 2 e		12	14 3 e	25	12	51 2 e		3	43 1 e
27	2	48 1 e		13	10 2 e	26	6	59 1 e	28	22	13 1 e
28	21	16 1 e	24	10	23 1* e	28	1	28 1 e	30	1	59 2 e
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			30	13	36 3 i	31	14	26 1 e			
				15	45 2 e						
				16	12 3 e						

Sep-

Septemb.				Novembr.				Decembris.				Quartus Umbrae Fo- vis hoc Anno non in- greditur propter Orbitae Latitudinem Fovialis Umbrae semidiametro majorem. Accedet tamen ad Longitudinem Ecclip- sum temporibus infra notatis.			
d	b	'		d	b	'		d	b	'					
1	11	11	1 e	1	22	51	2 i	2	9	40	1 i	Jan.			
2	15	18	2 c	2	7	48	1 i	3	22	14	2 i				
3	4	12	3 e	4	2	16	1 i	4	4	8	1 i	Febr.			
5	5	41	1 c	5	12	7	2 i	5	5	11	3 i				
5	0	10	1 e		20	44	1 i		22	35	1 i	Mar.			
6	4	37	2 e	6	13	31	3 i	7	11	30	2 i				
	18	39	1 e	7	15	12	1 i		17	3	1* i	Apr.			
8	13	8	1 e	9	1	24	2 i	9	11	30	1 i				
9	17	56	2 e		9	40	1 i	11	0	46	2 i	Maii			
10	07	38	1 e	11	4	08	1 i		5	57	1 i				
	8	13	3 e	12	14	40	2 i	12	9	5	3 i	Jun.			
12	2	7	1 e		22	36	1 i	13	0	25	1 i				
13	7	15	2 e	13	17	27	3 i	14	14	0	12 i	Julii			
	20	36	1 e	14	17	4	1 i		18	52	1* i				
15	15	05	1 e	16	3	56	2 i	19	13	20	1 i	Aug.			
16	20	34	2 e		11	32	1 i	18	3	16	2 i				
17	9	34	1 e	18	5	59	1 i		7	47	1 i	Sept.			
	12	15	3 e	19	17	12	2* i	19	12	58	3 i				
19	4	4	1 e	20	0	27	1 i	20	2	14	1 i	Nov.			
20	9	52	2 e		21	22	3 i	21	16	32	2* i				
	22	32	1 e	21	18	55	1* i		20	42	1 i	Dec.			
22	17	2	1 e	23	6	28	2 i	23	15	9	1 i				
23	23	12	2 e		13	22	1 i	25	5	47	2 i				
24	11	31	1 e	25	7	50	1 i		9	37	1 i				
	16	15	3 e	26	19	44	2* i	26	16	52	3* i				
26	06	00	1* e	27	2	17	1 i		19	28	3* e				
27	12	31	2 e	28	1	17	3 i	27	4	4	1 i				
28	0	29	1 e		20	45	1 i	28	19	3	2* i				
29	18	58	1 e	30	8	59	2 i		22	31	1 i				
					15	12	1 i	30	16	59	1* i				

Octobre toto 7
sub Radiis Olan-
tet.

Stylo veteri ut
horas a Meridie
numero more A-
stronomico.

A discourse concerning the effects of the great Frost, on Trees and other Plants Anno 1683. drawn from the answers to some Queries sent into divers Countries by Dr. Rob. Plot S.R.S. and from several Observations made at Oxford, by the skilful Botanist Mr. Jacob Bobart.

THE Cold now approaching and threatning, easily puts us in mind of the rigour and severity of the last unparallel'd *Winter*; wherein Men, Beasts, Vegetables, and most part of what had any life in it, felt its cruel assaults; some proving able to withstand, and other forced to suffer under it's so unusual and rude a season; which extream cold and frost happening in our time, gave occasion of taking notice of some of it's extraordinary effects, which to enumerate in the several parts of the *Creation*, and discourse of each subject and what operation it had upon each part thereof, might rather employ a large *Volume*, then a discourse, the present intention being only to give some relation of its working among *Vegetables*, and to incite others for the future to the consideration of the *procedure* of the cold, and how it operates upon such *bodies*, that thereby we may, being fore-warned, be in some measure prepared for the better *preservation* and *defence* of many things in that nature in other *winters*, the mildest and best whereof, proves troublesome to many *Plants*, though in the general it does kindness to the *Earth*, and it's future product.

In this *rigid season* nothing seemed more surprizing to us, nor more generally known to be true, then the *cleaving* or *splitting* of *Trees* in the time of the hard Frost: To endeavour therefore for what satisfaction could be obtained in this particular the Learned Dr. Plot sent these Queries following to several Persons of
Quality

Quality living in different parts of the *Nation*, desiring their opinions and answers, that by comparison, some judgment might be made of so unusual destructive and unwelcome a matter, which especially bent its force against *Oakes*, as a stout enemy assaulting the strongest fort.

1. Whether other *Trees* were split besides *Oakes*?
2. Whether any did split with a noise?
3. Whether all *Trees* did split towards the same point of the compass?
4. Whether the splitting were more common in the trunk or in the boughs?
5. Whether any *Ice* were found since in any of the *Vessels* of the *Wood*?
6. Whether the *Trees* split, be any of them dead?
7. Whether any of the *Trees* split have closed since?
8. Whether they are split *Through*, or only on one side?
9. Whether the bark by splitting be loosened from the wood?
10. Whether the roots have been any ways affected as well as the *Bodies* of the *Trees*?

In answer to the first of these, 'tis too well known that other *Timber-trees* besides *Oakes* were also cleft, as *Elmes* by Mr. Langley's house the Minister of *Tamworth*, and *Asbes* of considerable bulk and value, designed for, and capable of diverse uses, as *Windmill-posts*, *Dresser-boards*, and other necessary occasions. Also *Walnut-trees* in diverse places have suffered by this calamity, and proved extreamly cleft; tho' indeed it hath been most frequent among *Oakes*, many of which have been divided to great detriment in *England*, some being so rent that a man may see through them, and that many times the *Cracks* came with so great noise (which may answer the 2d *Querie*) that as it is related from *Needwood* Forrest they made such a noise, that the *Keepers* there thought that the *Deer* were shot by the people of

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the Country, and that in several parts they were heard as loud as *Guns*, some having been cruelly affrighted, especially in the *Evenings* or *Nights* as they have passed within the hearing of this so unexpected and surprizing a noise. Which *rifts* or *clefts* were (as in answer to the third *Querie*) not only to the same point of the *Compass*, but sometimes on one side only, sometimes 2 and sometimes 3 and sometimes 4 several places, dividing or quartering the Tree, and sometimes quite through (as the eighth *Querie* seems to examine:) and these *clefts* not only in the *bodies*, but continued into the larger *boughs* and limbs of the Tree, in answer to the forth *Querie*, and sometimes descended into the *superficial roots*, answering to the 10th *Querie*, but not to those very deep in the Earth, the Frost though extream, not reaching considerably deep comparatively to the roots of Trees, and the hard binding of the Earth being so frozen would not easily admit of compressure, but several shallow roots so knotted and knurled not to be wrought upon with *betle* and *wedges*, are known to be cleft by the *frost*: But it is much to be doubted and suspected whether any such *cloven trees* were so perfectly sound and faithful Timber, if proved by the *Saw* and *Axe*, as they ought to be; for if so, all might equally suffer, the *Air* having impartial access to one as well as the other, but some being taken with this *disease* and other left untouch't, there certainly was some cause or defect in these liable to it, rather than the rest. What it was that might give occasion to some only, might prove a matter worthy of enquiry. A great part of the cause is supposed to be *imperfection* in such a Tree, and that generally from the too large *sap-vessels* and unnatural cavities therein, which some call *Wind shaken*, and some *Lag'd-trees*, the cause whereof remains yet to be examined, whether the shaking of the *Wind* may not, with its great weight and force, taking the whole Tree with its boughs limbs and

and body, having one end firmly fixed in the Earth, at some age or other, as well work wrack and make splintering and stretched pores, passages, cavities and such like in a live and growing Tree, at some time of continuance of its force with its oft repeated beating, twisting, and pressing blasts; as well as the best chosen Mast of a Ship may suffer damage by the same cause, even to total fraction. By some this is supposed to proceed from *Earthquakes*, but whether or not, is yet to be examined. But the opinion of some seems not to be extravagant who think it to be an original distemper in the Tree, and to proceed from the *soil*, or rather an innate disease from some tho undiscernable imperfection in the *seed* it self, and yet not so much but that they live many years, and grow to great bulk and stature, but are observed to bear *lesser leaves* and *smaller Acornes*, but whether the *soil* be concern'd may be urged? the Trees about *Oxford* Westward, being generally affected with this disease, and those from the East side prove excellent sound Timber, and the soiles seeming to resemble one another.

But by what means soever this may come, it is certain that some *Trees* are much more sound then other, and that some prove full of inbred diseases and cavities, before they are cut down, which *cavities* and *stretcht vessels* being fill'd with too great a quantity of aqueous and undigested sap, as it were Hydropical (for it is thought that the genuine and natural sap of these our native Trees though undergoing condensation will remain secure and safe, as may be supposed from those that are well and firmly standing) are thereby rendred capable of not only condensation but glaciation also by the continuance and severity of the Aires frigeactive power; which being sufficiently known to employ more room being Ice than when formerly liquid, might probably cause these *breaches*, and if we consider the expansive motion and spring of the *Aire* included in the

cavities of the *air vessel*, suffering more pressure than they are patient of, from the coagulated and contiguous aqueous parts then congealed, may be induced to suppose these strepitous eruptions to proceed from thence. But whether Mr. *Hobbs's Hypothesis* will certainly hold, that the swelling is caused by the intrusion of the Air, is somewhat to be doubted.

It need not prove troublesome to any to think the *air* to be able to tear the *Oakes* or other Trees, who shall consider the great force and elastick power thereof, whereof that most excellent and Curious Philosopher of our age *E/sq; Boyle* hath in his History of Cold set forth several *Experiments* and *Examples*, as Vessels of several kinds of *Mettals*, being made strong on purpose and fill'd with water close stopped and exposed to the Cold, which being not capable of withstanding the expansive force of the inclosed *Ice*, have been found cleft and broken; as for instance a strong *Barrel* of a *Gun* close stopped, with water in it, and *frozen*, hath prov'd rent longwaies, and never a cross the *Vessel*, nor *bodies* of the *trees* we here mention: Another time a brass-vessel of a *Cylindrical* form being made not more then 5 inches deep and not 2 diameter fill'd with Water and afterwards *frozen*, in one night lifted off the cover prepared and closely fitted, with a weight of 56 pounds that was laid upon it. *Olearius*, Secretary to the Duke of *Holfsteins* Embassy into *Russia*, tells us that in the City of *Mosco* he observed (the cold being very intense) the *Earth* to be cleft many yards in length and a foot broad, which according to conjecture was occasioned by the heaving and swelling thereof to enlarge its roome, as here we see *Ice* crackt and cleft considerably long and broad according to its thickness along the ridge or turgid part thereof. And that the *earth* doth so rise when *frozen* is easily made manifest by little *sticks* or *plants* set into the ground against the approaching Winter, which being risen 2 or 3 inches

inches or more according to the *depth* and *strength* of the *frost*, and upon the thaw the Earth sinking to its former station leaves the unfixed Plants with their roots naked above ground, as it were spewed out. And not such moist bodies only, but *Metals*, as *Brass*, *Iron*, &c. have been swelled in the time of being *frozen*, as hath been proved by *Clocks*, *Locks* and other *Instruments*, and become laxed and plyant again upon the *Thaw*. Many more *examples* might be easily produced to induce us to the thoughts that the *sap* is not right and genuine in such ill disposed Trees, and that *Ice* might upon due examination be found in any such *bursten* bodies, as we are informed hath been found and observed by some, which may prove somewhat in answer to the 5th *Querie*: and if *Ice*, then pressure, and if pressure, then breaking and explosion.

It may be doubted too, whether some of these *Trees* thus liable to the fury of the *Frost* have not been *Coltie*? a term commonly used among *Timber-Merchants* and by them avoided, which is towards the middle of the *Tree*, among the *Annual Circles* some one is much larger than the rest and the *Sap Vessels* there seem much extended beyond their fellows, and upon cleaving or sawing such a *Tree*, that inclosed or inward heart, part thereof where that Circle is, will slip and drop from the other part oftentimes without any force to divide it, as an *Instrument* out of a *Cafe* or *Mould* made fit for it.

Some suppose that these *Wind-shaken* or *Lagd-trees* may be known or nearly guessed at by the outside when growing by the great *Ribbs*, 2, 3, or 4 in a *Tree* from the bottom to the branches, and that they have been affected somewhat considerably with this *disease* before, and perhaps *cleft* (tho not in so great a measure as now) and the *fissures* closed up again, as we see these to do quickly after the *Frost*, insomuch that it is scarce discernable already, and in answer to the 9th *Querie*,
the

the *barke* having not been divided from the body, upon coming together again each turn and twist of the grain fitting its place prove fresh and vigorously growing, which may satisfy the 6th and 7th Queries, but that ever such Trees will prove whole and sound doth scarcely consist with reason or our present thoughts. And this *Calamity* hath not been found in only *Trees* that were fresh and standing, but also in *Trees* cut down, as is affirmed by Mr. *Shish* the *Master-builder* in his *Majesties* Ship-yard at *Detford*, and from divers others, but notwithstanding it is thought to be only among such diseased *Trees* as are before mentioned.

But it is yet to be questioned whether *Vines* have proved cleft and crackt along the bodies by the same way and reason as *Timber-trees*, which decay is especially to be seen on *Walls* exposed to the *Southern* aspect, so that the *Sun* our accustomed Friend, now proved our great enemy, by *thawing* and *relaxing* the *Sap* every day, and then being *frozen* and made stiff again every night, which often repetition of *bending* and *unbending*, *softening* and *hardening* the vivid spirituous Juice being destroyed, and Day and Night the drought vigorously acting, (the *Sap* being this Year disordered and surprized, not gradually seasoned, even before *Michaelmas* day, and the fresh *Sap* to supply its defects being wholly detained from arising, there then being none or very little exhalations or evaporations arising out of the frozen and bound Earth) these poor slender bodies fill'd only with thin and not viscous *Sap*, have proved as great sufferers as if by amputation they had been deprived of their natural sustenance; for if they could have none from the Earth, and their own true *juice* mortified, and it be certain that *omne siccum appetit humidum*, it will follow that such branches will by the constancy and continuance of such severity (the Day being as bad as the Night) prove as dry as sticks cut off long before : where-

as those of this kind and other sorts also growing in more shadowie parts and undergoing but one change have remained in good condition, especially among *Red Grapes*, which seem much more hardy then *White* ones.

We see other *Wall-fruits* on the same position as *Apricocks*, *Peaches*, *Plums*, *Cherryes*, &c. not at all injur'd or prejudiced by the *weather*, which are of a more clammy viscous juice : These we see run sometimes and give gum ; but the *Leakage* of *Vines* is as thin as *Water*, which different *Juices* and *Saps* in other *Trees* and the degrees thereof, as well those with deciduous leaves as *ever-greenes*, may prove some cause of the weakness and decay of some, whilst that of another sort standing by remains fresh and vigorous, only stagnated, sedate, and quiet, waiting for the benign *Suns* beames to actuate, lenifie, and put its spirits in motion, and its comfortable refreshment to arise in due season ; And perhaps according to the degtee of this qualification in *Trees* and *Plants* (some being much more sluggish then other) may be the cause of their earlier or later *germination*. But to rightly examine and consider the severall and distinct *Juices* of *Trees*, every one certainly differing from each other, and the alteration so easily made by what *salts* or *spirit* each rejoices in, and their severall commixtures, and the many *Coates*, *Passages*, *Streyners*, *Vessels*, and the different procedure of each, would prove a large task, though much facilitated by the Learned *Malpighius*, whose great curiosity hath been shewed on this subject.

It is easily observed that in dry, Mountainous, Rocky, and barren Plantations, where *Trees*, *Greens*, and other *Plants* having been sparingly fed, and not pampered with such *Luxuriance* and freeness of *Sap*, as in the *Valleyes*, and richer *Soils*; have escaped tolerably well, and by this which in other *Years* proves their *poverty* and *disease*, now make them insult over those growing in the *fatter Valleyes* proportional to the height of the *Hills* they grow on.

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We may observe *Trees* all the *Winter* while the *sap* remains condensed to be safe and well, but if a flattering too early glance happens in the *Spring* to set their parts in *action*, and the *juices* to become *fluid*, and a sudden mutation of that *warmth* to a fresh return of *Winter*, (which too frequently happens in *England*) that then we have not only our hopes of that years *fruits* blasted, but even the *passages* in the *branches* and *boughs* stopped, and the crude *sap* settling commonly called *bliting* (tho there be many causes of the effects which go under that notion) becomes a *disease* in *Trees* equal to that of *Child-blanes* in juvenile blood, which sometimes takes whole *trees*, and sometimes *branches* only; Hence is supposed the decay of the *Glastenbury Thorne*, whose arising time being between *Michaelmas* and *Christmas* being sap-pily prepared by the beginning of the hard *Frost*, which hath almost affrighted it out of its life.

Some *Trees* and *Shrubs* seem to have their Vessels and passages so streightened and as it were shrunk with *cold*, that they appear equal to a human body *sinew-shrunk* or *paralytick*, that is not without much trouble able to move or bear his decaying limbs; Thus we see *Trees* with their *barke* schriveled, with their passages half stoppt, whose *sap* now only squeezing and difficultly passing, hath much ado to force its way through the dried and narrow pores and passages of the *body* and *branches*, and sometimes this distemper is so prevalent that whole *branches* of a *Tree* are kill'd when the other part is indifferent well.

Some *Liquids* such as *Essential Oyles* do rather shrink than encrease being *frozen*, and *Empereumatical Oyles* will hardly freeze but waft, which considerations may introduce the thoughts of what some *Trees* are made of, or do abound in, as *Firrs*, *Pines*, &c. which are capable of enduring the cold of *Normay* and other Countries.

These and many other such *considerations* here, but
some

some whereof hinted, may require and deserve farther and more particular examination and improvement, but at present having mentioned these things in general some or other hereof may perhaps suit with, and prove applicable to some or other of these particulars hereafter to be mentioned.

What *Timber-trees* have suffered, are above specified, but diverse other of our native Trees and Shrubs have scarcely proved able to withstand the force of so rude an enemy. *Yew* and *Holly* (things whose tenderness was never suspected) were in some places quite kill'd, and in many places so discouraged loosing their leaves, and blemishing the bark, that it is to be feared they will never take on their pristine Splendour and Verdure. The *Furze* in many places quite kill'd, and in most places cut down and spring again, but often the resurrection in vain expected; *Common Broome* proves a degree hardier; In some places the Sunny side of a *Juniper* bush proves *scorch't* between *Sun* and *Cold*, but that proves one of the most hardy of our native Greens; so that it is hard to say what is Winter-prooffe, even among our Natives, except *Box* and *Ivy* which stand in defiance of all.

And after this to look into the *Gardens* (which generally are *Nurseries* of *Exoticks*, and from *warm Countries*) and to think how great destruction hath there happened is directly *renovare dolores*, and this *Calamity* taking off the especial beauty thereof hath principally bent its force against *Winter-greens*, such as *Alaternus* (commonly known by the name of *Phillurea*) and the true *Phillurea* also, which are generally kill'd, though some upon cutting down spring again. Also common *Bayes* seen in most places to be kill'd down, and *Lawrell* seldom proving impatient, is in some places kill'd, in some places half dead; *Rosmary*, *Laurustine*, *Halimus*, *Arbutus*, *White Jasmine*, and other which seldom fail, are generally kill'd through the whole *Country*. But of

all these and other such like, in *Mountainous* and *dry places* (as was before observed) there is brisk life and verdure yet remaining though rarely to be met with, but however enough to retain the several *species* among us. But if for the future in such times of *extremity* the superficies of the Ground, and bodies of such things here recited and *Fig-trees*, were well covered with *strawy matter* to keep off the *Frost*, it might so preserve them as to spring out plentifully the Spring following, though their whole *tops* being too large and high, and thereby incapable of such covering, might loose their present leaves and beauty, which might from such respringing be easily repaired, and prove much more satisfactory, then to begin the world anew, as we are generally forc't to do for *Cypresses*, which were us'd to be excellent *Ornaments* both in Summer and Winter, now it proving a very rare thing to see one well alive; In some places there appears some lingering life, but scarcely sufficient to recover the whole, but in most places are quite dead, that have faced 40, 50, or 60 *Winters* before; After some *Winters* they appear somewhat scorcht and russet, upon which Esq; *Evelyn* directs the beating and thrashing them with a good tough Hazle wand, or such like, to ease them of their dead leafy parts, and admit the refreshing Air to the inward parts and branches, but this year their disease is beyond the power of such a remedy, but from Seed they will within few years be repaired.

Also among those with *deciduous leaves*, divers have been sufferers, as *Arbor-Jude*, young *Plane trees*, though those of considerable stature have pretty well escaped, *Paliurus*, The *Aleppo Ash*, in some places the *Locust Tree*, and in most hedges the great common *Bramble*, and some other, which upon cutting do some or most of them spring again.

But such *Greens* also as we receive from, and are the
glory

glory of warmer *Countries*, and very rare, curious and pleasant with us, such as *Oranges*, *Lemons*, *Myrtles*, *Pomegranates*, the perfuming *Jasmines*, and divers other rarities which are usually kept in *Pots* and *Cases* for the convenience of removing them into *Green-houses* and *conservatories*, not being able to endure our milder winters, have in many places extreamly suffered, especially in houses of weaker defence, but where the skill, care and due management of their *Keepers* have met with the convenience of good warm Houses, with keeping constant *fires* (which is a matter to be regulated with great discretion) according to the proportion of which combining qualifications, the *Plants* have escaped, as in some places most of them are well, in some places half, and in some places all dead ; but with additional care and secure keeping, as the enemy encreaseth, they even the most tender are to be kept and produced in the *spring* to our great satisfaction and pleasure.

But indeed in the *Spring*, being flattered with some warme *glances* and refreshing *daies*, to the great danger, many are apt to expose their *choise greens*, which upon a suddain change to its former *Cold*, with sharp *Eastern* winds, proves more pernicious to such *strangers* as well abroad as out of houses, then all the former *Winter*, and seems to finish the destruction of what the former *Cold* hath spared, a matter too frequently seen among us, we enjoying no certain steady Summer till after the *solstice* ; But these tender *Exoticks* loosing their leaves having received detriment, with their tops shriveled and the like, are oftentimes not capable of enduring the interposing scorching heat of the *Sun*, which sometimes happens by fits in the *Spring*, when the prudence and care of the *Gardener* is especially tried, gradually to help and recover his *sick Patients*, sometimes by due trimming, earthing with fresh sustenance, loosening the strait bound earth, and sometimes with the help of a warm bed, and

gentle watering and shadowing and the like , patiently and carefully waiting till the return of the bounty of the *Heavens* to help his *endeavors*.

Among *Plants*, *Herbs*, and *Flowers*, there hath been great destruction also, and many of common use, as most of the *Artichokes* of *England*, and winter *Coleflowers*, *Sage*, *Tyme*, *Maſtick*, *Lavender*, *Laven-Cotton*, and divers other were generally kill'd, except ſuch as happened to be new planted that year, and ſo low that they had the enjoyment of the kind covering of a little *Snow*, which proves the moſt natural, *feeding*, and *warm covering*, of any thing to be mentioned; but what peeped its head above it ſeemed in great danger of being kill'd; And as we may ſee in the *Corn-fields*, that thoſe ſides of the *Lands* of *Corn* facing the *South* where the *Snow* was melted and the *Corn* deprived of its covering, the want proved deadly, and in many places Husbandmen were forced to begin again in the *Spring* to plough and ſow other *Grain*; which may eaſily teach us rather to heap *Snow* upon our *Herbs*, and *Flowers*, then fancy it a cold unkind enemy. But in the *Flower-Garden* eſpecial obſervance ought to be taken that the *Choifer Roots* of the *Aſian Ranunculi*, *Aulmoneys*, *Tender Narciffi* and divers other of the like tenderneſs and ſtrangers to ſuch entertainments as our *Northern Countries* afford, that if hard *Froſt* ſhould happen upon the *Thaw* and melting of ſuch covering, ſhould be ſecurely covered and kept from the *Froſt* if poſſible, till the too *frigid moiſture* of the *Earth* be digeſted, which would prove pernicious even to the *death* and *rottenneſs* of many ſuch *Roots* and *Plants*.

But after all this repetition of *ſorrows* we are to comfort our ſelves that ſuch *deſtruction* and *calamity* happens but very rarely, the like having not been known in the memory of man, if ever before; And that with due care and obſervance the growing *cold* might be kept off from ſuch things as are proved to be impatient of it; which are

are not all *Greens* in our *Gardens*, some being able to endure all the cold that ever came, as *Firrs*, *Pines* of divers sorts, *Cedars* of *Libanus* and *Virginia*, (though that of *Barmoodes* proves tender) *Arbor vitæ*, all the *Savius*, whereof the upright or *Berry-bearing*, is the best *Succedaneum* to *Cypress*, capable of finer cutting into *Pyramids* or other figures, or hedges, 6 or 8 foot high, and is one of the best of the *Tonsile Shrubs*; also the *Pyracantha* proves exceeding hardy, and makes good *hedges*. Divers others might be mentioned, and with additional care to help the weaker, some whereof are formerly spoken of, which perhaps may not feel such severity in our time nor many years after, we may not prove so *pufilanimous* as to be discouraged, but remain satisfied with the hopes that we may enjoy the pleasure and refreshing satisfaction in *Gardens* as heretofore.

*A Letter from Mr. Anthony Leewenhoeck Fellow
of the Royal Society, dat. Apr. 14. 1684. contain-
ing Observations about the Crifallin humor of
the Eye, &c.*

IN mine of September the 7th, 1674. I communicated my Observations concerning the *Crifallin humour* of the *Eye*; which I find to have been inserted by Mr. *Oldenburg*, in the *Phil. Transactions* Num. 108. p. 178. where I say, that the *Crifallin Body* (or *humour*) of the *Eye*, is in hardness much like a preserved *Nutmeg*; which with a *Razor* I cut in too, and so observed the same in parcels, and found it to consist of many *Orbicular scaly parts*, lying one on the other, which had their beginnings from the *Center*; all which parts consisted again of *Crifallin Globules*: And having suffered the said *Crifallin humor* to dry for 3 dayes, it became so hard, that in the cutting, it broke in pieces: as if it had been hard *Rozin*. And observing again, these parts, I found therein, not only the aforesaid *Orbicular scaly substance*; but further, that each scale, was again composed, of other Ring-like parts, and that these second were contrary posited to the other: Thus much I observed, on the *Crifallin* part of the *Eye*; to which, I add, that I compared the scaly parts to a *Globe*, made out of a number of thin papers, lay'd the one on the other, and that every paper or *scale*, was again constituted out of so many parts, as there may be lines drawn upon a *Globe*, reaching from one *Pole* to the other.

I have sometime since, again made several observations, concerning the *Eyes* of *Oxen* and *Cows*; for that often since my first observations, I have thought, that I had not yet discovered the make of the *Crifallin humor* of the *Eye*, so thoroughly as I might have done.

I therefore first examined the *Film* or *Membrane* which encloses it, and separates it, from the other humors of the *Eye*; and conceived that it was constituted of *Threds*; but at another time, tho there were great diligence used, I could observe none at all.

In these *Inquiries*, I have seen (though seldom) the impressions of the thred-like substance, of the outermost *scales*, of the *Cristallin humor*, in the forementioned *Membrane*; whence I concluded, that one use thereof might be, to fill up all the unevennesses caused by the *threds* in the *superficies* of the *Cristal*, and so to constitute a perfect *Round*.

Another use of it, may be, by compressing the *Cristallin humor* to alter its figure, and make it part of a greater or lesser *Circle*: and this being so, it may not improperly be called a *Muscle*.

Although (as before is said) it did not plainly appear, that the *Film* is constituted of *threds* woven together; I notwithstanding, make but little doubt thereof; because formerly, in the thinnest *Membranes* I have seen these thred-like appearances, and also for that I examined the parts thereabout and found a great many streaks or *Lines*, seeming to be *Lymphatick Vessels*, designed for the nourishment of the *humours* of the *Eye*; these I traced till they entred into the coat of the *Cristallin humor*, and then they grew so small that I lost the sight of them.

I further observed, that the aforesaid *Cristallin body*, was compounded of thin *scales*, placed upon one another: These seem'd about 2000 thick, for the *Axis*, where it was longest, was $\frac{2}{3}$ of an *Inch*, so that the distance from the *Center* to the *Circumference* is as $\frac{1}{3}$ of an *Inch*: now the length of an *Inch* being six hundred hairs breadth, (as I have often said) $\frac{1}{3}$ must be 200 hairs breadth, which being multiplyed by 10. (the number of *Scales* equal to the breadth of a *hair*) make 2000. *Scales*, the thickness of this *Cristallin body*. I have further observed, that each of these

these *scales*, is constituted of *threads*, which in a very neat order, lye by one another, so that each of these *scales*, is the thickness of one of the *threads*, the appearance hereof to view, I have represented, as well as I could, by Lines drawn in a Circle, Fig. 1. ABC. is the *Cristallin Body*, of the bigness it appeareth to the naked Eye, B, is the part lying next the *Cornea Tunica*; but these I have magnified, that I might the better represent the *threads* constituting every *scale*. Fig. 2. KEFGHIL is represented, as if the aforementioned Fig. Num. 1. lay with the round B next the *Eye*: and altho I have here drawn many Lines, which represent as many *threads*, yet is their number nothing to those, in the Circumference of the *Cristallin humor* of an *Oxe*, which are above 12000. For 10 *threads* lying close together side by side, making not out one *Diameter* of an haire's breadth, now if the whole *Axis* (as before is said) is 400 haire's breadth long, then is it long 4000 of those *threads*. And this computed by the common Rules, amounteth to 12571 $\frac{3}{4}$. the number of the *threads* lying side by side, and which make out the whole circumference of the *Cristallin Body*.

Hence may be perceived how thin these *threads* are, and how wonderfully they run not through the *Axis*, as I heretofore conceived, but taking 3 several wayes out of the point L, (the imagined *Axis*.) These *threads* do not approach the *Axis*, on the other side of the *Cristallin body*, as they do on this, but turne back, with a small bent making there the shortest *threads*. For example, the shortest *threads* here, viz. MK. HN. and OF. reach up to the *Axis* on the other side, and fill up the place; (as is here represented at L,) now the *threads* MK, having filled up their place, in the *Axis* of the other side, (as the *threads* ELI doe here) they returne from thence back, and are here the shortest *threads* HN. These HN place themselves again, on the other side near the *Axis*, and returning back again, are then OF. and OF coming from the other

other side nigh the *Axis*, is here again KM. To conclude, those which are here the shortest *threads*, are on the other side the longest; and the longest on the other side, are here the shortest. To present this yet clearer to view, I have drawn with lines, the *threads* composing one of the scales of the *Cristallin body*, seen on one side, as *Fig. 3.* R T P S W Q, and notwithstanding it is a *flattish* round, I have here made it *Globular*, with consideration, that in this Representation, the *threads* constituting each *scale*, may be the better discerned. P and Q are the middle points or *Axes*, of which P in the foregoing *Fig. 2.* is denoted by L, the *threads* issuing out of the point P, in the foregoing *Figure 2.* L extend to V, where they are the shortest *threads*, from whence they again extend back to P, where again they are the longest, and from P they again extend to W, where they are again the shortest; and thus also are extended the *threads* from T to Q, and from thence again to X, and from X to Q, and thus half the course of every one of the *threads* (since we must suppose this for an half round) is demonstrated. In short the *threads* LI, in the foregoing *Fig. 2.* are here PS; and the *threads* between L and M in the foregoing figure 2. are here the *threads* between P and X; and the *threads* between L and O in the foregoing *Fig. 2.* are here, the *threads* between P and T. So that the *threads* in the foregoing *Fig. 2.* between F O L I K E, are here in *Fig. 3.* the same with R T P S. Here is further to be observed, that the *threads* constituting the *Cristallin Body*, are thickest about R and S, and the nearer they approach to P or Q, they are the thinner. To conclude, when we view the fore-said *Cristallin body* with attention, as it cometh fresh out of the *Eye*, we find it to excel in transparency the purest Glass, notwithstanding it is composed of so many thousand *threads*, and that they lye very close compact together, so that one might justly wonder, how the light can pass through them in right lines, which is absolutely necessary;

cessary; for if it were otherwise, the *Cristallin body* would appear white, but not transparent. To please some curious persons, and to represent this *Cristallin body*, yet plainer to their sight, I have taken a small *Tennis Ball*, and wound the same about, with a very fine *Cord*, having before stuck in many small *pins*, in the places where it was to be kept from slipping; then I smeer'd the *Ball* over with strong *Glem*, and when it was well dryed, took out all the *Pins*, and this *Ball*, with the *cord* wound about it, representeth the *Cristallin Body* of the *Eye*.

I have heretofore said, that the parts, which I now plainly perceive as threds; are again constituted of *Globules*; which now in some of the *threds* I clearly discern. But, for that I alwayes discern it not, I conceived, that as the *threds* (as here before is said) are very small, and clotted one to the other, that so in the separating of them, some parts of one thred remain fastned to the other, which may appear to my sight *Globules*: I conceived it might better agree with their *Fabrick*, to suppose that each *thred*, was again composed of many other smaller *threds* joyned together, as I have heretofore said, that the *Flesh threds* although 9. times thinner then a hair of our head, are again constituted of other *threds*.

I further took out of the *Eyes* of *Sheep*, *Hogs*, *Dogs*, and *Cats*, the *Cristallin bodies*, and ordered them, as I had done those of an *Ox*; but have found not the least variation; either in the *scaly parts*, or in the course of the *threds*, composing each of those *scales*.

The same agreement I found also, in the *Eyes* of *Hares*, and *Rabbits*; except that whereas the *threds* constituting the before-mentioned *Cristallin bodies*, spread themselves from the *Center*, in three distant *courses*; here the *threds* of each *scale*, spread themselves but in two courses. Fig. 4. A B C D representeth half the round of the *Cristallin body* of the *Eye* of a *Hare* or a *Rabbit*; E is the *Center*, which lyeth extended to the *Apple* of the *Eye*; these

these *threads* constituting each *scale*, which run as through the *Center* E, are on the other side, the shortest, and appear like unto F or G. likewise F and G, on the other side run through the *center*. I have also caused the foregoing *Figure* to be drawn side-wise, the better to represent the thread-like appearance of each *scale*. I suppose then, that the threads, which in *fig. 4.* are represented between E and F, are the same with those in *Fig. 5.* represented by I O. so that the *threads*, which come from the point I (the same with E in the former figure.) end here, in N and L; where they are the shortest; and those which extend to O, through, or close to the *center* M, where they are the longest, end there, or bend again on the other side, as the same do here. In short those which here approach the *center* I, are on the other side furthest from the *center*.

In the aforementioned *Observations*, I have for the most part, endeavoured also to discover the nature of the *Vitreous humour* of the *Eye*; and which surroundeth for the most part the said *Cristallin humor*, for that I concluded, it was no watry matter, but rather a transparent *Muscle*; But notwithstanding all the means I thereto used, I could not make the least discovery thereof, for that this matter always changed into a watery substance.

I further examined the *Cristallin body* of the *Eyes* of *Fishes*, which are perfect *Globes*; and found them also constituted of like thin *scales*, lying one upon the other, as in those other *Animals* before noted: and each *scale* also composed of *threads*, but these *threads* run not in the same manner, as those of other *Animals*; yet, notwithstanding all the industry by me used, I could not discover the true course of them, for when the *threads* approach the *center*, they appear so thin, and so close joyned together, that the sight cannot trace them, and cause such a confusion, that I cannot be certain, whether they end in the *center*, or return again from thence. By *Fig. 6.*

A B C D. I represent the *Cristallin body* of the *Eye* of a *Cod-fish*, and although the circular lines representing the *threads* constituting each *scale*, be only drawn by a pair of *Compasses*, from the *center* A, to the *center* C, and therefore lye more distant one from the other, then in the foregoing *figures*; yet are the *threads* composing each *scale*, not thicker, except in the middle, as here B and D they are somewhat thicker; and the nearer they approach to A and C, they are the thinner. *Fig. 7.* is the true bigness of the *Cristallin body* of the *Eye* of a *Cod-fish*.

I have also examined, the *Cristallin* bodies out of the *Eyes* of *Birds*, only to view how the *threads* of the *scales*, constituting also the *Cristallin body*, run; and after many *observations*, I have discerned, that the *threads* constituting the *Cristallin body* of a *Turkey-cock*, are extended like those in *Fish*; but as the *Cristallin body* of a *Fish's* *Eye* is perfectly *Globular*, those of *Birds* are a flattish round: as *Fig. 8.* posited with its flattish side D towards the *Cornea Tunica*. And when from without the *Cristallin body* of the *Eye* of a *Turkey-Cock*, I had with a very sharp knife, taken off many of the *scaly* parts, to bring it to a smaller *Globe*, it changed its *Figure*, and became an *Oval*; as *Fig. 9.* where E, is the same point with D, in *fig. 8.* the *threads* being, where they meet, so thin and small, that at last they are not distinguishable. From whence we may conclude, that the *threads* of the *scales*, which lye nearest the *center*, are in the midst thin; as in *Fig. 6.* at B and D is shewed, and make thus an *Oval figure*: and that when the *Cristallin body* increaseth in magnitude, the *threads* become then in the midst thicker; and thus constitute a flat round; as I have perceived it, for the *threads* in the *Cristallin body* of a *Turkey cock*, in their thickest part, were thicker than those in an *Oxe*, *Hog*, *Sheep*, &c.

Before I leave this *discourse*, I cannot but mention, that I have by several wayes and means, seen with my naked

Eye,

Eye, a threddy substance, like that whereof the *Cristallin humor* consists: I shall only mention two of them, *viz.* I take a clean wine Glasse, and hold the Rim thereof close against the *Pupil* of one of my *Eyes*, while my other *Eye* is closed; and looking thus, firmly through the *Rim* of the Glasse, against the flame of a Candle, or other light, I perceive the *thred-like* appearance above named; as if through a *Microscope*, I had beheld a piece of a *scale* of the *Cristallin Body* of the *Eye*. Or closing one *Eye*, I hold the fingers of my hand, before the other *Eye*, so close together, that they leave but a small opening between them: this small space between the fingers, through which the *Eye* receiveth the light of the Candle, will represent a like thred-like appearance, as in the former instance.

I have often been aware, of a moisture lying on the out side of the *Pupil* of the *Eye*, containing some few very small *Globules*; which as oft as we close our *Eye Lids*, change place: From hence may be learnt, the necessity of the *Eye Lids* in us; and why *Fishes* which continually live under water, need them not, but should *Men* and other *Animals*, that live out of the water, not have them, they would soon be blind: For if the *Eye Lids* by their closing, did not constantly moisten the *Eye*, the *superficies* thereof, would dry up and Rumble: and that chiefly in the *Sun*, or before a hot fire. Also it is not improbable, that from the inner part of the *Eye* a moisture continually issueth through the *Cornea Tunica*, which by *Eye lids* is cleansed off; for when I had examined several *Hogs Eyes*, which had been scalded with hot water, to get of the hair, I for the most part observed, that a thin Film, which was on the *Cornea Tunica* of the *Eye*, was somewhat finged; whereby it waseasily separated, from that film, that was immediatly under it; and when I then pressed the *Eye*, a little, between my *fingers*, I perceived in several places, a thin watry matter to soak through:

through the Horny film, and lye like a watry damp on a *Glass*; and when I continued this pressing for some time, this *watry damp* encreased into small *Drops*, and at length run like water in a stream. This ought not to seem strange, considering the parts of the Horny Coat to be made of hollow vessels, like *veins*; very thin, and spread about in *Branches*.

I have lately taken the Horny coat of an *Oxe's Eye*, and have separated from it, seven *films*, extremely thin, in each of which, were a number of interwoven, very clear, and transparent *streakes*; which I judge to be, many of them, *blood Vessels*; but so small, that they contain none of the *Globules*, which cause the redness in the blood. By the rubbing of our Eyes, with our hand, we may so press these blood vessels, until they become so stretched out, that some of these bloody *Globules*, may get in, and remain there, for some time, which may cause that redness in our Eyes; which comes by our rubbing of them.

But to return again, to the *Eye lids*. As our *Muscles* and other parts of our bodies rest not, unless posited as they lay, when we were yet in the *Womb*; (as I formerly said) in like manner, the *Eye lids*, are not at rest, till the *Eyes* are closed, and therefore we cannot long continue the *Eye lids* open, but with force; and, that the same might not be wearied, we often close them, although we mind it not. I have seen People, that listning with attention, to a *Discourse*, have closed their *Eye lids* according to my *Calculation* 6000. times in an *hour*; whereas others, standing by them, closed them not, above 2000. times in the same time.

Since I wrote unto Mr. *Oldenburg*, in the year 1673. that the matter, causing the redness of our *Blood*, was constituted of *Globules*; I examined the blood of *Oxen*, *Sheep*, and *Rabbets*; and observed no difference in *magnitude*, between the *Globules* of those *Animals*, and those of *Men*: so that I conceived, that that matter which in
general

general made all *blood* red, was *Globules*. But, after I had tryed the *blood* of a *Salmon*, a *Cod*, of *Frogs*, &c. and found that the matter, which caused the *redness* therein, was made of parts oval, and flattish, (as I have before said) I examined the *blood* of several *Birds*; and have also observed, that the matter causing the *redness* of their *blood*, was also composed of like *Oval* flattish parts, with those of *Fishes*: so that I now concluded, that all *Animals*, whether *Birds*, *Fish*, or other Creatures that live in the water; have the parts causing the *redness* of their *blood*, consisting of the said *Oval* flattish parts, and if hereafter I chance to find the contrary, I will advise you thereof.

A dis-

A discourse concerning the rising and falling of the Quicksilver in the Barometer ; and what may be gathered from its great rise in Frosty weather, as to a healthy or sickly season ; presented the Royal Society March 20. 1683. by the Learned Dr. Martin Lister, Fellow of the R.S.

I Do not offer these things *Dogmatically* as though I had light upon certain *Truths* ; but only as probable *Conjectures*, and such as may as well account for the *Phænomena* of the *Barometer*, as any I know. I am of opinion, That it is not good, if we intend the *Advancement of Natural Philosophy*, to let any part of it rest too long upon one *Basis* ; For he that is once well pleased with an *Opinion*, naturally acquiesces, and seeks no further. However admitting the *Gravitation* of the *Air*, I have a mind to try how far I may go in some additional thoughts I have about the *Barometer*, though they may possibly be much different from what hath hitherto been proposed about it.

1. It is to be observed, that *Quicksilver* is not affected with the *Weather*, or very rarely, let that be either *Cloudy*, *Rainy*, *Windy*, or *Serene* in *St. Helena* ; or the *Barbadoes* : and therefore probably not within the *Tropicks*, unless in a violent *Storm* or *Hurricane*. The first is affirmed by *Mr. Halley*, who kept a *Glass* near two Months in the *Island St. Helena*, and the other of *Barbadoes* stands upon the *Credit* of our *Registers*.

2. In *England* in a violent *Storm*, or when the *Quicksilver* is at the very lowest, it then visibly breaks and emits small particles, as I have more then once observed ; which disorder I look upon as a kind of *Fretting* ; and consequently at all times in its *Descent*, it is more or less upon the *Fret*.

In this disorder of the *Quicksilver*, I imagine it hath its

its parts contracted and closer put together; which seems probable, for that for Example, the *Quicksilver* then omits, and squeezes out fresh particles of *Air* into the *Tube*, which increasing the *Bulk* of the *Air*, and consequently its *Elasticity*, the *Quicksilver* is necessarily depressed thereby, that is, by an external force or power; And also the *Quicksilver* must of it self come closer together in its own internal parts, that is, descend for both reasons.

And that much *Air* is mixt with it, appears from the Application of a heated Iron to the *Tube*, as is practiced in the purging of it that way; and also for that *Polisht Iron* will rust though immerst in it, as some *Philosophers* have lately observed.

Now whether the *Quicksilver* rises in the *Pipe* (which it certainly does in hot, and frosty weather) it may then be said to be in a Natural state, free open and expanded like it self, which it seems it ever is within the *Tropicks*, and with us only in very hot, and very frosty weather. But when it descends, it is then contracted, and as it were convulsed and drawn together, as it mostly is in our *Climate* of *England*, and more or less, as we guess; in all places on this side the *Tropicks*. Which contraction plainly appears from the Concave figure of both *Superficies*, not only in that of the *Quicksilver* in the *Tube*, but also (if well observed) in that which stagnates in the *Pot*, or *Dish* it self.

The difficulty seems to lye in the reconciling the same effect of the *Quicksilver's* rising in the *Tube*, from such seemingly differing causes, as great heat and intense Frost, and those who shall willingly assent to us in one particular, and grant us warmth, as a probable cause of its Restitution to its Nature, will yet be at a stand, how to imagine, that great *Frost* likewise should bring the *Quicksilver* nearer its own Nature too; I answer, that *Salts* liquified will coagulate or *Cristallize*, that is, will return

to their own proper Natures, both in Cold and in Heat ; and therefore tho most men practice the setting them in a cool Celler for that purpose, yet some (as *Zwelfer*) advise, as the best means to have them speedily and fairly Crystallized, is to keep them constantly in *Balneo*. Thus also the *Lympha* of the blood doth become a *Jelly*, if you set it in a cool place, and the same is by warmth in like manner inspissated.

Again that its no new *Opinion*, that water is naturally *Ice*, if no disquiet from some external accident hinder. * *Bornichius* the Learned Dane has said something for it ; And although some may think, that what he hath said, was a meer Complement to his own frozen Climate : yet I dare venture to add, in confirmation of that Doctrine, that *Salt* is naturally *Rock*, that is, naturally *Fossile*, not *liquid* ; And yet this is most like *Ice* of any thing in Nature ; not only because of its transparency, but also for its easy liquefaction, and the suddain Impressions and changes which *Air* makes upon it ; that its scarce to be preserved in its natural state of *Crystallization*. Also *Salts* of all sorts seem naturally to propagate themselves in a hard state, and to vegetate in a dry Form. The like is to be observed in *Quicksilver*, of its being a hard *Rock*, and also from its willingness to imbrace upon all occasions a more fixt State, as in its *amalgamizing* with almost all sorts of *Metals*.

It will not be amiss by way of *Corollary* (and indeed it is one of the great uses too, of a *Register* of the *Air*) to add a Note or two about *Healthful* and *Sickly* seasons ; more particularly as they may refer to this *Phenomenon* of great *Cold* and *Frost*.

If therefore *Quicksilver* and *Liquids* are nearest their own natures, and have less Violence done to them, in very cold and very hot seasons ; The *Humours* of our *Bodies*, as *liquids*, in all probability must be in some measure accordingly affected.

* *Acta Ranic.*

And that therefore *cold* is healthful, I argue from the vast number of Old men and women to be found upon the *Mountains of England*, comparatively to what are found elsewhere.

Again, the *Blood* it self; or the *Vital liquor* of *Animals* equivalent to it, is in most kinds of *Animals* in Nature sensibly *cold*; for that the *Species* of *Quadrupeds* and *Fowles* are not to be compared for Number to *Fishes* and *Insects*: There being in all probability by what I have observed, above a hundred *Species* of these latter creatures whose *Vital juice* is *cold*, to one of the former: But because we most converse with those whose *Vital Juice* is *hot*, we are apt to think the same of all.

Again I have observed, which I offer as an Argument of the little injury intense *cold* does to the nature of *Animals*, I say, I have seen both *Hexapode-Worms* (which I compare to the tender *Embryo's* of *Sanguineous Animals*, because such are in a middle State) and *Flyes* of divers sorts hard frozen in the Winter, and I have taken them up from the *Snow*, and if I cast them against the *Glass*, they would endanger the breaking of it, and make it *Ring* like so much hard *Ice*; yet when I put the *Insects* under the *Glass*, and set them before the *fire*, they would after a short time nimbly creep about, and be gone, if the *Glass* which I whelmed upon them, had not secured them.

It hath indeed been noted by a very wise *Philosopher* in contradiction to our *English Proverb* *, which saies, that a *Green Christmas makes a fat Church-yard*; That the last Plague broke out here at *London* after a long and severe winter 1665. But I reply, that that was accidentally onely, for that that *disease* is never bred amongst us, but comes to us by *trade* and *Infection*. Tis properly a Disease of *Asia*, where it is *Epidemical*. And therefore by the *Providence* of *God*, we are very secure from any such *calamities* as the Natural effect of our *Climate*.

And for the same reason, I judg the *small Pox* so much

* *Ray's Proverbs.*

raging at present, not to be from the *Season*, or temperature of the year, but from *Infection* wholly; that also being an *Exotic Disease* of the *Oriental* People, and not known to *Europe*, or even *Asia Minor*, or *Africa* at all, till a Spice trade was opened the later *Princes* of *Egypt*, to the remotest parts of the *East-Indies*, whence it originally came, and where it rages more cruelly at this day than with us.

The like I think of the *Gripping* of the *Guts*, that it is a peculiar *Disease* of the *West-Indies*, and yearly received from thence, for this reason, that is none of the *Tormina Ventris* of the *Antients*, and therefore called by a new name, by such as have writ of it; and also for that it is yet scarce known in any part of the *North* of *England*, or *Midland Countries* thereof *.

So that we are not to Judg or Prognosticate of the *Salubrity* or *sickliness* of a year, from forreign *Diseases*, but by the raging of such as are *Natural* to the men of our *Climate*.

But enough of this, only this word to conclude, that if the most Elegant and learned *Rivinus* be in the Right, which I shall not here dispute, that fear is ever the prime cause of the *plague* †; 'tis fit to recommend its *antidote*; which is chearfulness, and a reasonable security; that we are in no such danger from any *Intemperature* of the *Air* necessarily subsequent to so vehement a *Frost*.

* Dr. Willis *Dysenteria Alba Londinensis*.

† Rivinus de *Peste* -- *Contagium non est contagium, nisi accedat terror* - Sancto testor, me nullum lucusque vidisse egrum ex peste, qui non a terrore eam contraxisset.

SCOTIA ILLUSTRATA, five Prodrömus
 Historiæ naturalis, &c. Authore Roberto Sibbal-
 do M. D. Equite Aurato, Medico & Geographo
 Regio, & Regii Medicorum Collegii apud Edin-
 burgum Socio. Edinburgi in fol. 1684.

BEfore we give an account of the *book* it self, these few things ought to be premised concerning the *Nuntius Scoto-Britannus* which is prefixed by the *Author*, to this *Prodromus* and is an account of the *Atlas Scoticus* by him undertaken. It contains both the reason of his undertaking that great work, which, besides his *Majesties* expresse command, was the alteration of the *country* since the *Antients*; and the imperfect relations the Ignorance or partiality of the *Moderns* have given; as also the *series* or method of the whole *work* it self, according to its *books* and *chapters*; which is done chiefly to invite those who can any way contribute to so vast an undertaking, to communicate what they have in order to it. For the direction of which he has added his *Quære's*, as also a *catalogue* of the *books* he already has, both in *Print* and *Manuscript*, and of those he has heard of and cannot get, together with the *Geographical tables* which are not in *Bleau*, and are curiously drawn by Mr. *John Adair*.

In the *Prodromus* he hath shewn himself worthy of what he enjoys in being the *Kings Geographer* and *Physitian* there, but in this acts chiefly as the latter; for after he has discoursed of *Britain* in general, as to its Name, Limits, Dimensions and Figure, he does the same for *Scotland*; the *length* of which he computes to be 380. *English* miles, the *breadth* 190, though it is so often invaded by the Sea, that scarce any house in all *Scotland* is above twenty Leagues from *Salt water*, the longest day he makes to be 18. hours 25. min. though for two months, especially

ally towards the *Orcades*, the Sun beams are so plain all night, that it is easy to write and read by them. The *Antipodes* to *Scotland* he assigns in the *Terra Australis* near the *Magellanick Streights*, and looks upon that to be the truest division of the Country, by which it is divided into three *Peninsula's*. Hence he passes to the *Natural History*, beginning as nature herself does, with the four *Elements*. He finds no *burning Mountains*, but yet there are *Fields* which *Smoke* by day, and *Flame* by night, as also other *igneous impressions*. He tells us what sort of *Air* is best, what use or rather necessity we have of it, accounts for the *Spring* of it from its *Nitrosaline* parts; and because they are hardly one hour without *winds*, looks upon the *Scotch* air to be more pure and wholsom than the *English*, the *sweating sickness* never so much as invading their borders.

After having treated of *water's* being the *universal menstruum*, if not principle, defined and divided the *Sea*, and given us its properties of *Saltiness* and *motion*, he relates some various motions of the *Scotch Sea*; a particular *vortex* of which by the *Orcades*, sucks in whatsoever comes within its circle. The inhabitants fling in empty vessels, or bundles of straw, and so pass by without any danger, the *Sea* becoming plain as soon as it hath swallowed what was cast into it, which it again returns about a *mile* farther. He supposes the bottom of the *Sea* to consist as the *superficies* of the *Earth* does, of *Mountains* and *vallies*, *woods* and *mines*; whence *amber*, *ambergrise*, and whatsoever substance else the *Sea* casts up, proceed.

Petrifying Fountains are found here, as also one that foretells *storms*, called the *routing well* near *Edinborough*, by sending forth a great *noise* from that side of the *Fountain* which is opposite to the quarter whence the *Storm* is to come.

Mineral waters are frequent, but no *hot Springs*, the defect of which he supposes may be supplied by the external use of the water of *Moffet*, and the *bitumen* of *St. Katharines*

rines well, commonly called the *oily well*. And having treated of the conveniency of its being *Mountainous*, of its *woods*, and *mines*, from those of *Gold* down to *Coals*, he writes of the arable lands, and *grains* of the country, which are much the same with ours, of which *grain* the fertility of some grounds returns 16. or 18 for one.

The *Inhabitants* in general he looks upon as qualified for *arts* and *arms*, by the roughness of their soil, and the purity of their air. The Antient *Scots* lived *extempore*, hunting supplying meat, and the rivers drink, their *manners* being answerable to their course of life. They took such particular care that their race should not be wasted by *hereditary diseases*, that they prohibited *Marriage* to all such who were any way distempered.

In the *second Book Diseases* in general are handled, especially those of the *Country*, some extraordinary cases of which he relates, as of strange *hysterical fits*, of a woman with a large *horn* above her right ear; as also of a *Dropsie* of the right *Tuba Fallopiana*, out of whose leg came 44 *Scotch* pints of tinged water, with a great quantity of thick sediment at the bottom.

In his *Method of cure* he insists principally upon the convenience of *Medicines* of the growth of the *Country*, it being the *primitive practice*; and that he might promote as well as commend it, he has given an account of the *Medicines* which are produced there, and their *virtues*; and through all sorts of *Simples*, compares domestick with foreign ones, to shew how little need there is of *exotick Drugs*.

The *second part* is divided into 4 *books*; the first, after the various uses of *plants* considered with their definitions, parts and divisions, consists of a *Catalogue* of those *plants* which grow *wild*, to each of which is annexed the *characteristick* note taken from the *seed* and *fruit*, and the *virtues* of the *plant*, as to most is added the places where they are to be found. The *second book* describes *plants* cultivated

cultivated in *Gardens*, with a discourse of *Gardens* in general, and a description of the *Physick Garden* at *Edinburgh*.

The *third Book* informs us of the *Animals* of *Scotland*; from *Men* down to *Insects*; where after a discourse of *animals* in general, and of the dignity of *Man*, he mentions some men more eminent, and gives an account of the *Life* and *Works* of Mr. *Alexander Bodius*, whose *Effigies* he has likewise given us, &c.

He has annexed a discourse about the *Scotch Geese*, the *Fable* of which he confutes by a description of the *Cancha Analifera*, which is a perfect *animal* of it self, and allways remains so; and asserts that those *Geese* are known to build and lay Eggs, like other *Fowl*; though not in that *Country*, in which they only appear in *Autumn* and *Winter*. *Anatomy* also discovers in these all the *Vessels* for propagation of *Species* that are found in other *Birds*.

The last *Book* gives an account of the *Fossilia* and *Marina*, by which the *Country* seemes to be very well stored with *Earths*, *Metals*, *Stones* and *Minerals* of all kinds; the *Sea* is no less bountiful than the *land*; *Ambergrise*, *Succinum*, *Spermaceti*, &c. being the frequent effects of its Munificence. Several *Copper Plates* adorn and illustrate the books, all together make us impatiently expect the *Atlas* it self, the *Prodromus* of which is so satisfactory, that it seems to have prevented it.

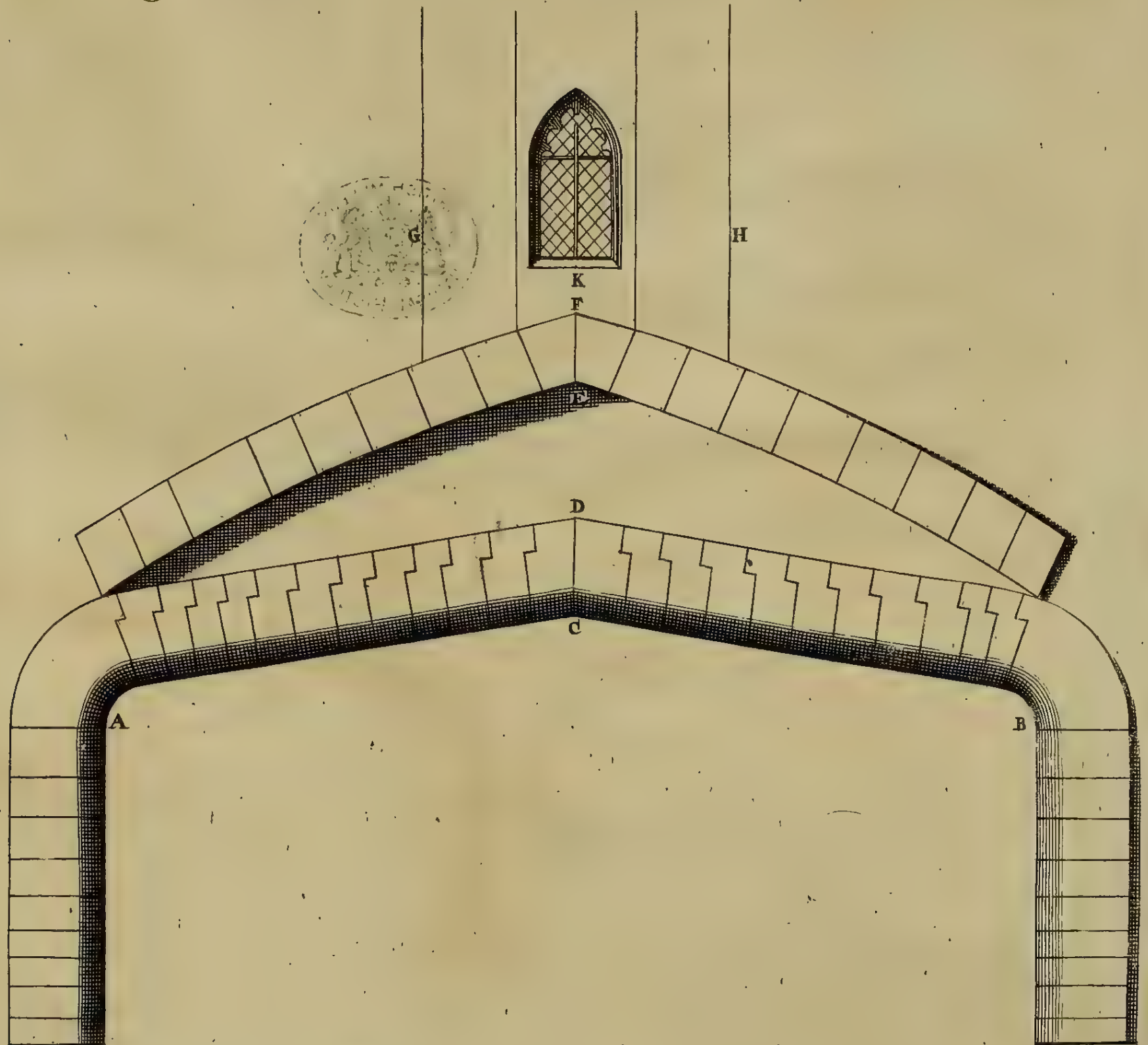
O X F O R D,

Printed at the *THEATER*, and are to be sold by *Moses Pitt*, at the *Angel*, and *Samuel Smith*, at the *Princes Arms* in *St. Paul's Church-yard* LONDON. 1684.

PHILOSOPHICAL

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Philosoph. Transact. Number, 166.



PHILOSOPHICAL

TRANSACTIONS.

Decemb. 20. 1684.

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An Extract of a Letter from the Reverend and learned Dr. John Wallis, to the Publisher Dr. Robert Plot; concerning two very large Stone Chimney-pieces: with a peculiar sort of Arch-work thereon.

HAVING been lately at *Edgecot* in *Northamptonshire*, at the house of *Tobias Chancey Esq;* he shewed me in an ancient Kitchen (now disused) two Chimney's, vastly large, of Stone-work. Which I took the more notice of, because of a peculiar way of Arch-work in the Front of them; whereby, without the advantage of a Discharger of Timber (which is usual, in such cases, to defend the Arch-work from being over burdened,) an Arch of massy Stone (in each of them) sustains it self, at a great length, though almost upon a flat, (being very little raised in the middle.) Which, because it seemed to me somewhat extraordinary, I caused a draught, of one of them, to be designed; as in the paper here adjoined. In which, the lower Arch-work (very little raised from a flat) is made of great Stones, so locked into one another, as appears in the Figure: that there might be the less danger of any one dropping out (or being forced down) to the destruction of the whole. Over which (after some walling interposed) there is another,

another Arch (to defend the former) more raised from the flat (than was the former) made of lesser Stones, and with straight joints ; (not locked as the former.) Over all which, the walling was continued upwards (in an ordinary way of walling,) forming (with the Back) two vast Tunnels of Stone ; and, between them (over the middle of the Chimney) a great Window. The Dimensions of all, I have thought fit here to subjoin.

AB. The Breadth between the Jambs, from inside to inside, 18 Foot.

CD. The Depth of the Stones in the Lower Arch, 22 Inches. Locked one into another, with a crooked Joint, as in the Figure.

The number of them, as is there to be seen.

DE. the Distance, in walling, between the Arches, 2 Foot and 7 Inches.

EF. The Depth of the Stones for the Upper Arch, 15 Inches : with a straight Joint.

GH. The place of the two Tunnels.

K. A window between them.

The other Chimney over against it, on the opposite side of the same Kitchen, was much after the same manner ; but (as I remember) somewhat less ; and with some difference in the Masonry.

*Some Queries whereby to Examine Mineral Waters
by the Learned Sir William Petty Knight.*

1. **H**OW much heavier then *Brandy*?
2. How much *common Water* will extinguish its Taste?
3. What quantity of *Salt* upon *Evaporation*?
4. How much

{	<i>Sugar</i> <i>Allom</i> <i>Vitriol</i> <i>Nitre, &c.</i>	}
---	---	---

 will dissolve in a Pint of it?
5. Whether any *Animalcula* will breed in it, and in how long time?
6. Whether *Fish*, viz. *Trouts, Eeles, &c.* will live in it, and how long?
7. Whether it will hinder or promote the *Curdling* of *Milk* and *Fermentation* of *Liquors, &c.*?
8. Whether *Soap* will mingle with it?
9. Whether it will extract the dissolvable parts of *Herbs, Roots, Seeds*, more or less than other water?
i. e. Whether it be a more powerful *Menstruum*?
10. How *Galles* will change its colour?
11. How it will change the colour of *Syrup* of *Violets*?
12. How it differs from other *Waters* in receiving the colour of *Chochenelle, Saffron, Violets, &c.*?
13. How it boyls dry *Pease*?
14. How it colours fresh *Beef* and other *Flesh* in boyling?
15. How it washes *Hands, Boards, Linnen &c.*?
16. How it extracts *Malt* in *Brewing*?
17. How it quenches *thirst* with *Meat* or otherwise?
18. Whether it *purges*? In what quantity of time and with what *Symptoms*?
19. Whether it promote *Urine, Sweat* or *Sleep*?
20. Whether it sharpen or flatten the *Appetite* to meat?
21. In

21. In what time it *passes* at first, and how afterwards ?
22. Whether it *Vomit, cause cough* &c ?
23. Whether it swell the *Belly, Leggs* &c. how, and in how long time and Quantity ?
24. How it affects *Sucking Children*, and the *Fœtus* in the *Womb* ?
25. Whether it damp or excite *Venery* ?
26. How *blood* (let whilst the waters are drunk) does look, and how it changes ?
27. In what degrees it changes in different degrees of *Evaporation*, and brewed ?
28. Whether it break away by *Eruclation*, or downwards ?
29. Whether it kills the Effect of *Asparagus* on the *Urine* ?
30. What quantity may be taken at a time impure ?
31. Whether a *Sprig* of *Mint* will grow in it equally as in other water.
32. In what Time it will putrify or stinke ?

*Solutio philosophica Casus cujusdam rarioris à Cl.
Domino Doctore Briggs, in Actis Philosophicis
Numb. 159. nuper editi, de Juvene vespere cæcuti-
ente.*

Vulgo notum, & à nemine (uti credo) oppugnatum, quod interdum quamplurimi vapores, à sole rarefacti, attolluntur, qui deficiente calore, post ejus occasum, à frigore densati, descendunt; quodque inde aer præcipue prope terram fit spissior. Ad eundem modum forsan humores in oculo dicti juvenis afficiantur; uti & vespere ab istis vaporibus aliquantulum spissiores vel magis turbidi facti sint: sicut urinis sæpe accidit, quæ pro ut frigori vel calori admoventur, turbantur vel clarescunt: Dum sol agit supra Horizontem, vi caloris sui, amotis vaporibus densatis, clarescunt oculorum humores, at cum Horizontem subit, (à causa contraria) humores turbantur, atque inde recta illa, quæ requiritur, dispositio oculorum immutatur: Nam ex spissitudine illa humorum, Radii retusi vel refracti, ad *retinam* vix pertingunt; vel si pertingant, agunt cum impulsione nimis debili.

Huic Hypothesi apte conveniunt omnia, quæ enumerantur phænomena; primo enim semper à cunabulis prædicto juveni contigit hic affectus sine defluxione, vel alio aliquo oculorum morbo; cujus causa est eadem peculiaris innata humorum diathesis, qui post solis occasum à vaporibus, ut supra, simili modo afficiebantur. Secundo cæcitas hæc gradatim obrepfit, à vaporibus post solis occasum gradatim descendentibus. Tertio ab influxu Lunæ nulla immutatio, quoniam ascensus & descensus halituum de influxu istius planetæ non pendent. Quarto suspicor intimos humores [nimirum *Crystallinum* & *Vitreum*] adeo esse viscosos, ut (clarescente *Aqueo*, tunica-

tunicaque *Cornea*) nequaquam dissipantur. Quinto cæcitas nec major nec minor vel in hyeme vel æstate ; ratio videtur, quoniam licet dicti vapores non semper pari copia descendunt, tamen semper tanta copia ut eundem effectum producere possint : sicut aliquando vidi aquas quasdam *acidulas* in vicinia nostra foliis quibusdam quercus contusis & infusis purpurascens, at color à fortiori infusione non intendebatur : Ita vespere semper satis vaporum descendendum ad effectum producendum ; at si plus satis, nulla immutatio.

Alius aliter sentit, quod cum nulla in prædicti juvenis oculis observetur *Nubecula* aut obfuscatio, rarioris hujusce *φαινομένης* ratio probabilior petenda est à dispositione Nervi optici, cujus tubuli influxu solari repleti, *species* (quas vocant *visibiles*) facillime admittant ; eodem autem destituti, flaccescunt, & ad visionem inepti redduntur.

A discourse concerning the Sepulchral Lamps of the Ancients, shewing the possibility of their being made divers waies, read before the Philosophical Society of Oxford, May the 7. 1684. by Robert Plot LL. D. Director of Experiments to the said Society.

Mr. President and Gentlemen,

YOU may well remember that at the last meeting, I shewed you that the downy part of the Mineral call'd *Linum Asbestinum*, *Earth-flax*, or *Salamanders Wooll*, would make, and do the office of a *Weik* tolerably well; it having burnt from about nine in the morning (being still supplied with Oyl) till about four in the afternoon (about what time that *Session* broke up) without sensible diminution: yet it was objected that upon other trials a *friability* had been found in it, which argued some sort of *consumption*; and that allowing it invincible in the fire, yet there might be some danger of its being clog'd by the *impurities* of the best Oyl that could be got, or any way prepared. To the first of which *Objections* it was then answer'd, that there was no such absolute necessity of making use of that *Wooll*, but that another *Weik* might be contrived, against which that exception could not lye; such as a *Metallin Wire*, especially of the best refined *Gold* (whose prerogative it is, not to be diminish'd by fire) that will lick up Oyl as well as any other *Weik*, and so make a *perpetual flame*, provided it be supplied with a *perpetual Oyl*: this I must confess I have often heard asserted, but never applied my self to the trial of the *Experiment*, till I received your commands to do it the last week; in execution whereof I found that in a *Faggot* of *Wire* made

made of *anneal'd Iron*, of a futable bigness for a *Week*, it would not succeed by any manner of means I could readily think of; nor have I much reason to think it will, after the most mature deliberation, either in *Wire* of *Silver* or *Gold* (though I dare not pronounce the contrary till trial has been made) the nature of them all seeming not much different, as to *this particular*. If therefore it be necessary, that we must have a perpetual *Week* for the making such perpetual *Sepulchral Lamps*, as were used by the *Ancients*, I think we must stick to the first kind, made of *Linum Asbestinum*, or *Salamanders-wool*; which if it any way can be supplied with a *perpetual Oyl* (as I shall presently shew you) I hope you will not judg me far from effecting the matter. Now that there may be such a *Bitumen* or *inexhaustible Oyl*, I shall not need to trouble you with the *Testimonies* of old *Authors*, or carry you into *Italy*, or other forreign parts: for will you but allow me an *inconsumable Week*, I will carry you no further than *Pitchford* in *Shropshire*, where there is a *Naphtha* or *liquidbitumen* (a *Specimen* whereof I have here to shew you) that constantly issues forth with a *Spring* there, and floats upon the *Water*: *this* I would have separated before it joynes with the water into a *ductus* of its own, and so conveyed to the place, thought most convenient for such a *Lamp*, into which it should as perpetually distill, as it does now into the *fountain*; which I doubt not but you will allow may be done, without any great matter of difficulty: and if so, we have an *Oyl*, as *everlasting* as our *Week*: nor need we to fear any *extinction* if inclosed in a *Tomb* or *Vault* under ground, in never so damp or moist a place; it being the *Characteristic* of a *bitumen*, to burn best where there is moisture, as is evident upon affusion of water upon *Sea-coal*. And this is one way I have thought of, that such a *perpetual Sepulchral Lamp* might possibly be contrived. But if you will be so strict with me, as not to allow

this to be a *perpetual Weik*, or that 'tis probable one should be made any other way; as unlikely may it seem to most (that I say not to this *Society*) that there was ever any such thing as a *perpetual Lamp*; notwithstanding the *Testimonies* of *St. Austin*, *Plutarch*, *Pliny*, *Ludovicus Vives*, *Baptista Porta*, *Licetus*, *Pancirollus*, and divers others, whereof some are said to have burnt a 1000, some 1500 years. But I dare not think so many, and so very good *Authors*, have all imposed upon us, or that 'tis almost possible that so many notable instances as are brought for them, should all be false. Much rather therefore shall I determine (than wholly explode the thing) that the *liquor* of these *Lamps* did burn without any *Snuff* or *Weik* at all, as we see *Camphore* and most *bitumens* will, it not being express'd (that I remember) scarce in any of the *relations* of these *Lamps*, that they were found with any *Weiks*, whence both the inconveniencies above mention'd attending a *Weik*, *ipso facto* cease. It only therefore remaining that we find out an *inexhaustible Oyl*, which conveyed to a fit vessel might cause such a *Lamp*; why may not our *bitumen* at *Pitchford* serve the turn? which no question will burn without a *Weik*, as well as any other *liquid bitumen*: for I begged not above in this instance the favour of a *Weik* out of necessity, but that I was willing to shew the probability of its being done as many waies as I could. All the objection I can foresee that is likely to obtain advantage against such an *Experiment*, is that such a *Lamp* as this, would as likely burn in the *open Air*, as in an inclosed damp *Vault*, whereas the *Lamps* of the *Ancients* did nourish their flame best, where there was most want of *Air*, only in close *Vaults* and *Tombs*, and were presently extinguish't upon the least immission of *External Air*, these being qualities necessary, and almost alwaies asserted as concomitants of the Ancient *Sepulchral Lamps*. To which I answer first, that some of the *Lamps* of the *An-*
cients,

cients, did as well burn in the open *Air*, as in close damp *Vaults*, as that mention'd by *St. Austin* in his book *de Civitate Dei*, which hung in the *Temple* of *Venus* alwaies exposed to the open weather, yet was never either consumed or extinguish'd. The *Lamp* also found in the *Tomb* of *Pallas* the *Arcadian*, slain by *Turnus* in the *Trojan War*, was of this kind, which remain'd burning after it was taken forth, notwithstanding either *Wind* or *Water*, with which some did endeavor to quench it. Now admitting our *Lamp* at *Pitchford* should thus burn indifferently under both circumstances, what are we the worse? Since I never heard that the *Lamp* mention'd by *St. Austin*, or of *Pallas*, were ever the less esteemed or admired, because they could not be extinguish'd by the open *Air*, as most of the rest have been said to be. But if any body be so wise that He must have an *Oyl* in all particulars answerable to that other sort of the *Ancients*, that burns best where there is want of *Air*, and is destroyed by its admission: let Him but go with me into *Flint-shire* to the *Coale-works* of *Sr. Roger Moslyn* of *Moslyn* in that *County*, and He may have satisfaction; where the *Miners* when they have dugg so deep, that they begin to perceive a want of *Air*, find a blewish flame to begin to kindle of it self in the fissures of the *Coal* (at which, by way of sport, they sometimes light their *Candles*) which blazes, and moves up and down continually, and sometimes shines too upon the surface of the water in the bottom of the *Pits*, shewing all the colours of the *Rainbow*: which yet upon drawing up of the water that annoyes the *works*, and thereby stirring the *Air*, will leave burning; but as they sink lower, and are more remote from the *day* or *superterraneous Air*, still increases upon them: whence it plainly appears that this is a sort of *fire* that so little requires *Air* for the maintenance of it; that it burns best when there is least *Air*, and is extinguish'd when disturb'd by the motion of it;

as the ancient *Lamps* are said to be, upon the *inmission* of *external Air*. This therefore must be the fire fittest for this sort of *Sepulchral Lamps* (for it seems they were not all alike) for the account whereof, we all stand obliged to an eminent member of this *Society*, the learned Dr. *Bathurst Dean of Wells*, and *President of Trinity College Oxon*. By whose care the relation of the strange *Phænomena* of this sort of fire, stand registerd in the *Philosophical Transactions*, Numb. 136. to all posterity. Since which it has also been taken notice of, in the *Coal-works* of *Sommerfet-shire*, by the ingenious Mr. *Beaumont*; and by Mr. *George Sinclair* in the *Coal-works* of *Scotland*. This I doubt not but you will readily allow me to be as probable a material for the *Oyl* of this second sort of *perpetual Lamps*; as that of *Pitchford* was, for the former: But how *this*, or *that*, shall be so menaged, as to be put into a *Lamp*, and this *Lamp* perpetually supplied, and placed wherever it shall be desired; as it seems the *Lamps* of the *Ancients* might, this fire being sometimes found in little *Pots*, *Glasses* or *Urnes*, without any such *ductus* to them as we required at *Pitchford*, or might do here; is a difficulty perhaps not easily conquered. To which I must confess that I have only this to say, that unless there can be a preparation *Chymically* made out of these *bituminous materials*, which thus naturally take fire of themselves, or preserve it without a *Weik*, a small quantity whereof shall maintain so tenuious a *flame* as that there shall be no considerable consumption of the matter in many years (such as the flame over the *Well*, and *Earth* about it, in one Mr. *Hawkley's* ground in *Lancashire*, that (like the fire of *Plato*) only *shines* and does not *burn*) we must be contented to be tyed to the places where these *materials* are. But if we can be content to quit these *materials*, and to think that these *Lamps* (as many have done) did not *shine* or *burn* for all the time they were inclosed in these *Tombs*, but were only
inkindled

inkindled by the *admission* of *Air* when open'd: I have thought of a way not at all lyable to any of the defects or inconveniencies, of the two former waies; whereby a *Glass* of *liquor* inclosed in another (like the *Urns* of *Olybius*) upon *immission* of *external Air*, shall certainly *shine*, though it did not so before. And 'tis this: take a small *Phial*, into which put a little of the *liquid Phosphorus* (which you all know, if the *Phial* be stopt, *shines* not at all, the *external Air* being excluded from it) include this in another *Glass*, as suppose the *recipient* of an *Air-pump*, out of which if the *Engin* be stanch, so that the *Air* may be well exhausted, the *solid Phosphorus* it self, will leave off *shining* in ten hours time, though in the Summer-quarter; and the *liquid* in fewer, so that it shall *shine* no more, than when the bottle containing it, is stopt with a *Cork*; and both of them will be extinguisht proportionably in a yet less time, if the *Air* be taken from them in the *Winter* season; as has been frequently experimented by my worthy Friend *Frederick Slare M. D.* and shall again be repeated as soon as I can procure a nice *Air-pump* fit for the purpose. Now let such an *exhausted Recipient* with the included *Phosphorus*, be placed in a *Tomb* or *Vault* which are commonly dark, and if ever found, and the outer *Glass* broken (as usually such things are, by ignorant Men imployed in digging) possibly there will appear, upon *immission* of the *Air*, as good a *perpetual Lamp*, as some that have been found in the *Sepulchres* of the *Ancients*, tho in all probability of a different kind, from all, or most of them.

A Let-

A Letter from Mr. William Musgrave Fellow of New College Oxon: and one of the Secretaries of the Royal Society, to the Learned Dr. Martin Lister, wherein He endeavors to prove that the Lacteals frequently convey Liquors that are not White.

Honored Sir,

THAT considerable Experiment of Yours, made for altering the colour of the *Chyle* in the *Lacteal Veins*, (which I have found to succeed, by injecting a pint of a Decoction of *Stone-blew*, into one of the *Intestina tenuia* of a Dog, kept fasting 36 hours &c.) does not only claim my assent to the Conclusion you draw from it, viz. That a color'd Liquor may find admittance into the *Lacteal Vessels*; but also has (in part) been the occasion of my inclining to an Opinion, That the Lacteals frequently convey liquors which are not *White*: In Confirmation of which Proposition, I must beg leave First to give you an account of some *Experiments* I have lately made, relating to this matter; and secondly to offer at some Deductions from them: The *Experiments* are of three kinds;

I.

I kept 2 *Dogs* fasting, one 48 hours, the other 3 daies, and then open'd them; in both a considerable number (above 20, where fewest) of the *Lacteals* appeared *Pelucid*, like *Lymphatics*; only not so full and turgid, as those under the *liver* are generally, or as the *Lacteals* themselves are sometimes, seen: I cut several of them
in

in each Dissection, and immediatly a *Transparent liquor* flowed out of the Orifice.

2.

A *Dog*, which had neither eaten, nor drank, in three daies, was suffer'd to lapp a quart of common water; an hour after which, he was opened; the *Lacteals* shew'd themselves in a great number (perhaps above 60,) all *limpid*, from the liquor contain'd in them, as in the former *Experiments*: part of the water was suppos'd to be still in the *stomach* and *small Guts*; for the quantity of water seen there, was far greater, then that in the *primæ viæ* of either of the *Dogs* kill'd fasting.

This *Experiment* was repeated with very little alteration in the trial, and the same success as before.

3.

Another *Dog*, after three daies fasting, had a peice of fat Meat given him; an hour and half after which, he lapt (about) a Quart of common Water, and half an hour after this, was open'd: I first tied the *Ductus Thoracicus*; then examin'd the *Lacteals*; which I saw in as plentiful a number, and as full as (perhaps) they were ever seen in this *Species* of *Animals*: eight, or ten, of them at the first opening of the *Dog*, appear'd perfectly white; very many of a faint diluted white; but most of them were Pellucid; especially at the latter end of the Dissection; by which time, several, which at first were either of a lively, or of a fading White, were now grown transparent: that I might satisfy my self as to this difference in the colour of these vessels, I open'd the *Intestinum Jejunum*, and *Ileon*, in several places; and found the water was got as far as the *Cæcum*; and had carried down diverse little parcels of the meat with it;

by

by which means the liquor seen in the *Lacteals*, at the first view of them, was either of a perfect, or of a diluted white, or else pellucid, according to the mixture of the meat with the water in the guts.

I ordered about 3 pints of broth to be given a *Dog*, which had been kept fasting 24 hours, and opening him 4 hours after this, I observed the *lacteals*, beginning at the *Duodenum*, (with which the other small guts, and stomach) was very much distended with the matter of the last meat: all the *Lacteals*, that I saw at first, were of a perfect white colour; several of which I prest between my fingers, drawing them from the circumference toward the Center of the *Mesentery*, by which means I found, that the *Chyle*, contain'd in these *Vessels*, appear'd White, when it ran in a shallow stream, as well as when it fill'd the *Lacteals*: Viewing the rest of these *Vessels* along toward the *Cæcum*, I observ'd, that, near the middle of the *Intestinum Ileum*, they began to be of a more diluted white, and a little farther, they were really pellucid, and as turgid, to appearance as those that were White; after which turning back again toward the stomach, I saw the same *Vessels* (I think) in as great numbers as at first (perhaps above 80) but the colour of most of them was chang'd, for they were all now pellucid: some 3, or 4 which I at first cut asunder for my better enquiry into the *white Chyle* contain'd in them at that time, being limpid together with the rest. The same thing succeeded in a *Dog* kept fasting 2 daies, and then open'd 3 hours after he had lapt 3 pints of Milk, part of which was seen in the stomach of the *Dog*: about 15 of the *Lacteals*, arising from the *Duodenum*, were white; above 100, proceeding from the *Intestinum Jejunum*, and *Ileum*, were, more, or less, transparent; as also were those of the *Duodenum* at the latter end of the operation.

2. This being the Relation of matter of Fact, let us
now,

now, in the second place, examine, what is the Consequence, what the Effects, of all this slaughter.

1. The *Experiments* of the first kind do sufficiently prove, that the *Lacteals* convey not only *Chyle* (which results from aliments lately taken into the stomach, and may be call'd *Liquor Novitius*,) but also another humor separated (as is most probable) from the blood, and now returning to it again; which (by means of the aforesaid *Experiments*,) may be seen purely by it self, without any mixture of *Chyle* with it.

As to the place, where this *liquor Refluus* (for so we will hereafter term it) parts from the blood; particularly whether it be a *Lympha*, properly so call'd, arising in the musculse Veines of the *Intestines*? Or whether it be a liquor emptied into the hollow of the *Stomach*, and *Intestines*, from the *Pancreas*, *Glandularum plexus Fragiformes*, and perhaps the *Liver*; or thirdly whether it proceeds partly the former, partly the latter, way; is a Question not easily determin'd. *Caspar Bartholin*, who looks on himself (and it may be justly enough) as the first observer of the *Lacteals* appearing sometimes limpid, like *Lymphatics*, has these words in favor of the former of those Opinions; having spoken before of the *glandulose Tunics* of the *Intestines*. He saies [*si verum sit, quod magnam veri speciem habet, Lymphatica ab aliis partibus non glandulosis oriri, has (scilicet lacteas) ab Intestinis Lympham superfluum revehere dicam.*] *Diaphragmatis structura* pag. 95. But as far as I can judge at present, it seems not unreasonable to derive at least part of this Liquor from the hollow of the *Intestines*; if we consider, that the *Pancreas*, and *Glandularum Plexus Fragiformes*, (not to mention the *Liver*) do daily discharge a liquor into the *Intestines*; which (considering that *Dogs*, after three daies fasting, will, as I have often observ'd, have very hard faces in their *Intestina*

Reſta) we cannot well diſpoſe of any other way, then by ſaying, it reenters the blood by the *Laſteals*, and is that very liquor, which conduces to the making ſome of them appear transparent after ſo long a faſt.

2 It ſeems probable, from the ſame forementioned *Experiments* of the firſt kind, That the *Laſteals* are very ſeldom, or never, all empty at the ſame time; for tho the *Chyle* flows only in certain *Tides*, or *Flaſhes*, *proratione Ingeſtorum*; yet the *Liquor Reſluus*, running in a more conſtant ſtream, does, when there is no Flaſh of *Chyle* going in, keep the *Laſteals* from being abſolutely empty.

3. But, to come nearer to my purpoſe, tis farther evident from the ſame *Experiments*, that this *Liquor Reſluus* is, in its own nature, *transparent*; and paſſes ſuch thro the *Laſteals*, after long faſting, when no *Chyle* is mixt with it; which is no inconfiderable ſtep to the making out of my Proposition, if we recount how long, and how often, very many *Quadrupeds*, beſide Men, do faſt from all ſorts of aliment; during which time, after the *Chyle* of the laſt Meat, or time of drinking, is all mixt with the blood, we may ſuppoſe that this pellucid *Liquor Reſluus*, goes alone into the *Laſteals*.

4. The *Experiments* both of the ſecond, and third kinds, ſeem to intimate, that a great part of the *Chyle* it ſelf is, in its journey thro the *Laſteals*, altogether *Limpid*: againſt which if it be objected, that ſome of the *Laſteals* were, in a like manner, pellucid, in all the *Experiments* of all the three kinds, and therefore it does not appear but that they may be fill'd with a *liquor Reſluus* in the 2 laſt *caſes*, as well as (for certain) they were in the firſt *Caſe*; to this Objection, beſide what may be answered from the extraordinary number, and fulneſs of the *limpid laſteals* in the 2 laſt kinds of *Experiments*, comparing theſe *Veſſels* with thoſe of the ſame

same sort seen in the first kind (which comparative excess cannot be imputed to any cause so reasonably, as to the matter given the *Dogs* a little before the Dissections of the 2 last kinds;) beside this I say, it may farther be replied, that in all the Instances of the 2d and 3d *Cases*, a considerable quantity of aliment was taken in by each *Dog*, not long before his Death; That some of this matter was seen in the *primæ viæ* of every one of them when dead; (an argument it was not all Distributed;) That there is no way, certainly known, by which liquors are discharged the *primæ viæ*, in this *Species* of *Animals*, beside *Vomiting*, *Seige*, and by the *Lacteals*; and that, seeing neither of the 2 former took place, it may not be unreasonable to suppose, That part of this matter was, at each dissection, in its way thro the *Lacteals* to the blood; all the operations being at such distances from the time of the matter's being taken in, at which most liquid aliments are observed to swell up the *Lacteals*.

But farther, whoever shall insist upon this Argument, if he derives his *liquor Refluus* from the Musculose Tunics of the *Intestines*, is liable to the objection before mentioned against that opinion; if from the *Pancreas*, *Glandularum Plexus Fragiformes*, and *Liver*, will find it no easy thing to account, why *this liquor* should be admitted the *Lacteals*, and the water (taken *in specie* in the *Experiments* of the 2d kind; as also in the first Instance of the 3d kind; and included in the broth given in the second instance of the third kind) should be excluded; altho in some of these Instances it was seen to have almost reacht the *Cæcum*: especially since it is sufficiently prov'd, That *Decoctions* of *Indigo* and *Stoneblew* (of which *Decoctions* far the greatest part is Water) have found the way into the *Lacteals*.

Now if it be not too precarious to suppose, That the Liquor, seen in the *Pellucid lacteals* of the 2 last kinds of

Experiments, did, in a great measure (for I by no means exclude the *liquor Refluus*) consist of the matter lately taken in before the *Dogs* were opened; we may with good reason imagine, That water, drunk on an empty Stomach, (as it was in the second Case) by several other *Quadrupeds*, and *Men*, as well as *Dogs*, will pass the *Lacteals*, not under a white colour, but rather *Pellucid*; and these *Cases* are not uncommon amongst us; particularly this seems to hold true in those, who drink great quantities of *Diuretic Mineral Waters*, in the morning, fasting; of which suppose any person takes, and Evacuates, 3 Quarts, by Urine, in the forenoon; and, with his dinner, and in the afternoon, drinks 3 Pints of Bear, or the like (allowing that all the *Chyle* produced from what he takes in at dinner, and in the afternoon, amounts to 2 Quarts, and that these 2 Quarts of *Chyle* are perfectly White; which in all probability is not true; yet, I say, according to this favourable account) three Pints of *Pellucid*, for 2 of *white Chyle*, will pass the *Lacteals* in this person, in 24 hours. And what is here said of Water, is not unlikely to be true (*mutatis mutandis*) of several other liquors, as *Wine*, *Bear*, &c. at least so far as that they may not pass white thro the *Lacteals*, which is sufficient for my purpose. Again, if this *principle* be true, the third kind of these *Experiments* will go yet farther and argue, That the whole quantity of *Chyle*, arising from some sorts of Meat, and Drink, taken either at, or near, the same time; or from some sorts of Meat taken alone; is not alwaies white; for the *Lacteals*, which appear'd perfectly white in the several Instances of the third kind, were far inferior in number to those that were *Pellucid* in the same Dissections: But the proportion of the White, to the Diluted, and the *Pellucid*, *Chyle*, depends upon so very many Circumstances, (as the quality of both meats, and drinks; the distance between the time of their being taken; and the proportion

tion of one to the other) that it seems almost impossible to determine it.

From the Premises it appears, there is some reason to induce us to think, that the Lacteals *frequently* convey Liquors, which are not white ; and that *Chyle* may (not improperly) be divided into three sorts at least, viz. *White*, *Pellucid*, and *Intermediate* to these ; contrary to the opinion of those *Anatomists*, who thought it to be alwaies white, as that word is contradictinguisht to [*Pellucid*] ; altho by [*Chyle*] They understood (as I likewise do) the Effects of Drink, as well as Meat, Concocted.

This (Sir !) is the summ of what I shall trouble you with at present, concerning this subject ; an account of which I here send you, having been assur'd, it will meet with a welcome at your hands ; and indeed the whole being a Building on your foundation , the right and Title of it does of Consequence belong to You : But that which gives the greatest encouragement to the writing of this Letter, is, that I know I write to one, who has Candor to excuse, as well as Judgment to discover, my Errors ; to the former of which I must of necessity be oblig'd, and am not averse to the latter ; but shall rather be glad, if I may know your sentiments concerning the matter in hand, which way soever they shall tend, whether to a Confirmation, or a Confutation of this Opinion.

An ingenious Retraction of the 7th and last Paragraph of Mr. William Molyneux's Letter in the Philosophical Transact. Numb. 158. pag. 554. concerning Lough Neagh Stone and its non application to the Magnet upon calcination. Being an abstract of a Letter of the same ingenious Gentleman dated from Dublin Novemb. 25. 1684.

— **T**IS now a good while since, I gave you some account of our *Lough-Neagh* Stone and its petrifying qualities, which I hear you have thought worthy to insert in one of your *Transactions*; in which discourse I must desire you to correct one *Paragraph*, and undeceive the World in a *particular* there mention'd; which is, that *Lough-Neagh Stone*, neither crude nor calcined, would apply to the *Magnet*: that it will not do so *crude*, I still affirm; but that it does not apply *calcin'd*, I must retract: for I find by further trial, that it apply's *calcin'd* most briskly, and in great quantities, to the *Magnet*: The occasion of my former *error* being, that I did not *calcine* it long enough. If upon a fit opportunity you would do me justice in this *particular*, you will much oblige me, and vindicate my credit. Sir, I am

Your most humble Servant,

William Molyneux:

*Directions for the use of the following Tide-Table, sent
by J. F. M. R. & R. S. S. to the Publisher.*

SIR,

HAVING found my two last years Tide Tables very agreeable to Experience. I here present you with another for the year ensuing made by the same Theory and Numbers. I must only desire those that use it, to note.

That when by reason of long droughts in Summer, or continual hard Frosts in Winter, the fresh Waters are low, as also when the winds blow hard at N. or N. W. the Tides may hold up longer than the times shew'd in the Table.

But when the contrary winds blow hard, or by reason of great Rains the Freshes are increased, they hold not out so long: yet have I very rarely found the difference more than half an hour.

I find by enquiry made amongst our most experienced Seamen, that the high Waters of our English and Neighbour Ports keep a good correspondence with these of the River of *Thames*; Having therefore instructed my self the best I could by conference with them, I have made the following Table of Reduction, whereby the Tide Table may
be

be made to serve at the places underwritten,
by Adding,

	<i>h. m.</i>
For <i>Tinmouth-haven, Hartlepool, and Amsterdam</i>	0 30
<i>Brest</i>	1 00
<i>Sylly</i>	1 45
<i>Bridlington-Peer and Humber</i>	2 00
<i>Pensans, Weymouth, Hamburgh, and Hull</i>	3 30
<i>Lanion and Foulness</i>	4 10
<i>Bridgewater, Landsend and Texel</i>	4 45
<i>Portland, Hareflew, and without the Olie</i>	5 40

And Subtracting.

For <i>Leith, Maes, and Gouries Gut</i>	0 15
<i>Gravesend, Rochester and Rammikins</i>	1 00
<i>Buoy of the Nore, and Flushinghead</i>	1 20
<i>Shoore Beacon, Redsand, Portsmouth, Ostend</i>	2 30
<i>Spithead, Harwich, Dover, Calice and Dublin</i>	3 00
<i>Orfordness, Gunfleet, Hastings, Shoreham and Diep</i>	4 00
<i>Needles, and Yarmouth Peer</i>	4 40
<i>St. Hellens and Haverdegrace</i>	5 30

The Table is Printed in a single half Sheet by it self
for the use of those that desire to have it alone, and is
to be sold by Mr. Baker at the Sign of the *Three Pige-
ons* in *St. Paul's Church-yard, London.*

**A Correct TIDE TABLE, shewing the true times of the *High-Waters* at *London-Bridge*,
to every Day in the Year 1685. By *J. F. M. R. & R. S. S.***

D		Jan.		Febr.		March.		April.		May.		June.		July.		August.		Sept.		Octob.		Novem.		Decem.	
		H.	M.	H.	M.	M.	H.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	M	6	09	6	47	5	30	6	45	7	21	8	44	9	06	11	23	1	02	1	33	2	21	2	27
	A	6	29	7	12	5	50	7	14	7	51	9	16	9	41			1	29	1	54	2	39	2	46
2	M	6	51	7	38	6	14	7	45	8	23	9	50	10	20	0	02	1	54	2	14	2	57	3	04
	A	7	15	8	07	6	39	8	18	8	55	10	23	10	58	0	38	2	15	2	32	3	13	3	21
3	M	7	39	8	38	7	06	8	52	9	28	10	58	11	37	1	13	2	36	2	49	3	28	3	38
	A	8	05	9	10	7	34	9	27	10	00	11	31			1	44	2	54	3	05	3	44	3	54
4	M	8	33	9	43	8	05	10	00	10	34			0	15	2	10	3	10	3	20	4	01	4	10
	A	9	01	10	17	8	39	10	35	11	06	0	05	0	51	2	33	3	23	3	35	4	17	4	26
5	M	9	29	10	51	9	14	11	09	11	38	0	39	1	25	2	53	3	40	3	49	4	34	4	43
	A	9	59	11	27	9	50	11	42			1	12	1	55	3	11	3	54	4	04	4	52	5	01
6	M	10	30			10	25			0	09	1	43	2	23	3	28	4	09	4	19	5	12	5	20
	A	11	02	0	00	11	01	0	13	0	39	2	12	2	48	3	44	4	24	4	36	5	34	5	40
7	M	11	33	0	32	11	35	0	43	1	08	2	39	3	09	3	59	4	39	4	53	5	55	6	02
	A			1	02			1	10	1	37	3	02	3	28	4	14	4	55	5	12	6	19	6	25
8	M	0	05	1	30	0	07	1	37	2	04	3	23	3	47	4	30	5	12	5	34	6	44	6	49
	A	0	34	1	55	0	37	2	02	2	30	3	44	4	05	4	45	5	33	5	56	7	12	7	14
9	M	1	03	2	19	1	06	2	25	2	53	4	05	4	21	5	01	5	54	6	22	7	41	7	40
	A	1	30	2	41	1	33	2	46	3	15	4	25	4	38	5	20	6	18	6	49	8	09	8	08
10	M	1	56	3	00	1	59	3	06	3	36	4	45	4	56	5	39	6	43	7	17	8	40	8	38
	A	2	20	3	17	2	22	3	26	3	56	5	05	5	14	5	58	7	11	7	47	9	11	9	10
11	M	2	41	3	34	2	42	3	45	4	17	5	27	5	34	6	20	7	40	8	20	9	41	9	41
	A	3	01	3	50	3	02	4	05	4	39	5	49	5	53	6	43	8	12	8	52	10	13	10	16
12	M	3	19	4	07	3	20	4	25	5	02	6	13	6	14	7	09	8	45	9	24	10	45	10	50
	A	3	36	4	24	3	37	4	46	5	27	6	36	6	35	7	36	9	19	9	56	11	15	11	26
13	M	3	53	4	41	3	54	5	10	5	53	7	02	7	00	8	05	9	54	10	29	11	45		0
	A	4	09	5	01	4	12	5	36	6	20	7	27	7	23	8	36	10	27	11	01			0	01
14	M	4	26	5	22	4	31	6	05	6	49	7	53	7	50	9	09	11	02	11	33	0	17	0	36
	A	4	42	5	45	4	51	6	35	7	18	8	20	8	17	9	43	11	35			0	47	1	10
15	M	5	01	6	11	5	14	7	08	7	46	8	46	8	46	10	17			0	03	1	15	1	43
	A	5	20	6	39	5	39	7	41	8	17	9	13	9	15	10	51	0	08	0	31	1	43	2	12
16	M	5	41	7	11	6	07	8	16	8	47	9	40	9	46	11	26	0	35	0	59	2	10	2	39
	A	6	04	7	45	6	38	8	50	9	16	10	08	10	17	11	58	1	03	1	24	2	35	3	04
17	M	6	29	8	25	7	12	9	23	9	45	10	38	10	48			1	28	1	48	2	58	3	25
	A	6	57	9	01	7	46	9	55	10	13	11	07	11	20	0	29	1	52	2	12	3	20	3	46
18	M	7	27	9	40	8	23	10	27	10	39	11	36	11	52	0	58	2	13	2	34	3	42	4	06
	A	8	00	10	20	9	00	10	58	11	07					1	25	2	35	2	55	4	04	4	25
19	M	8	35	10	58	9	37	11	27	11	35	0	03	0	22	1	49	2	53	3	15	4	25	4	45
	A	9	13	11	35	10	14	11	54			0	30	0	52	2	13	3	11	3	43	4	47	5	05
20	M	9	51			10	50			0	01	0	58	1	20	2	33	3	28	3	54	5	10	5	27
	A	10	31	0	09	11	23	0	20	0	26	1	23	1	46	2	52	3	45	4	14	5	36	5	47
21	M	11	10	0	41	11	54	0	44	0	50	1	47	2	10	3	09	4	03	4	35	6	02	6	10
	A	11	48	1	10			1	07	1	13	2	10	2	32	3	25	4	21	4	57	6	29	6	33
22	M			1	36	0	24	1	29	1	36	2	31	2	50	3	41	4	40	5	23	6	57	6	58
	A	0	25	2	00	0	50	1	48	1	57	2	51	3	09	3	57	5	02	5	50	7	26	7	22
23	M	0	59	2	20	1	14	2	08	2	17	3	10	3	25	4	13	5	27	6	21	7	55	7	47
	A	1	29	2	40	1	37	2	26	2	36	3	27	3	41	4	30	5	53	6	54	8	25	8	14
24	M	1	56	2	57	1	58	2	44	2	55	3	44	3	57	4	47	6	23	7	26	8	53	8	42
	A	2	21	3	13	2	17	3	00	3	12	4	00	4	13	5	08	6	56	8	00	9	23	9	11
25	M	2	42	3	27	2	34	3	16	3	28	4	17	4	28	5	30	7	29	8	35	9	51	9	40
	A	3	01	3	42	2	51	3	31	3	46	4	33	4	45	5	54	8	08	9	10	10	20	10	10
26	M	3	19	3	55	3	06	3	47	4	02	4	50	5	03	6	22	8	46	9	42	10	47	10	39
	A	3	25	4	10	3	21	4	03	4	19	5	08	5	23	6	53	7	24	10	14	11	15	11	09
27	M	3	50	4	24	3	35	4	19	4	36	5	28	5	44	7	26	10	1	10	44	11	42	11	38
	A	4	05	4	38	3	50	4	36	4	54	5	48	6	07	8	03	10	38	11	14				
28	M	4	19	4	53	4	04	4	54	5	14	6	11	6	32	8	42	11	12	11	42	0	07	0	07
	A	4	35	5	11	4	19	5	14	5	36	6	35	7	01	9	23	11	47			0	34	0	36
29	M	4	50			4	35	5	36	5	58	7	01	7	32	10	03			0	09	0	59	1	04
	A	5	06			4	51	5	59	6	22	7	30	8	05	10	43	0	16	0	34	1	23	1	29
30	M	5	24			5	10	6	24	6	47	7	59	8	43	11	22	0	44	0	59	1	46	1	53
	A	5	42			5	32	6	53	7	14	8	31	9	23	11	57	1	09	1	21	2	07	2	15
31	M	6	01			5	53			7	42			10	03					1	43			2	36
	A	6	23			6	18			8	13			10	43	0	30			2	02			2	56

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An account of a sort of Paper made of *Linum Asbestinum* found in Wales in a Letter to the Publisher, from Edward LLoyd of Jesus Coll. Oxon.

I N obedience to your commands I have here sent you all the account I am able to give at present of the *Lapis Amianthus* or *Linum fossile Asbestinum* which you were inform'd (and that truly) was to be found in the Isle of *Anglesey*: wherein I shall choole to refer it to your own judgment to determine whether this be the same kind with the *Asbestos* of the *Ancients*, or in some respects different from it. Nor shall I mention any thing out of *Authors* relating to it; well knowing that would prove but needless to you, as being not unacquainted with whatever has been said of it: But shall onely give you some bare informations of it from my own *Experience*. It is found in no small quantity in the Parish of *LLan-Fair yng Hornwy* in the Northern part of *Anglesey*; where it runs in veins through a Rock of Stone in hardness and colour not unlike *Flint*. These veins are generally about $\frac{1}{4}$ of an inch deep; which is the length of the *Amiantus*, and is seldome longer, but often shorter. It is compos'd of a *lanuginous* matter exactly resembling that of *pappous Plants*; but so closely compact, that till you draw a Pin, or any such sharp thing, cross the grain of it, it appears onely a shining Stone; there being not the least filament of *lint* to be perceived in it. In its natural form some of it looks *whitish*, and some *Straw-colour'd*, but all shining: but if pounded in a Mortar, the brightness disappears, and the whole becomes *whitish*. Note that above and beneath the veins there's a very thin *septum* of terrene matter between the *Amiantus*, and the Stone whereto it adheres. I put a small quantity of the *lint* in the fire, which grew red hot; but though it remain'd there $\frac{1}{4}$ of an hour, I could not perceive that it was any thing consumed. I twisted some of it also in form of a *Week*, as you had done that

of *Cyprus* before, and dipping it in *Oyl* it gave as good a flame as other *Weeks*, till the *Oyl* was consum'd; the *Week* remaining in the same proportion as at first. Being satisfied it was *incombustible*, and instructed by one of your *Chymical Lectures* in the *Natural History Schoole*, that *Paper* had, and might be made of it, I resolv'd to try whether any could be made of *this*; which if not useful, might at least prove surprizing to such as knew not the material of it, by its not yielding to the fire; to which end I pounded some quantity of it in a *Stone Mortar*, till it became a downy substance and seem'd very fit for that purpose. Then I sifted it through a fine *Searce* by which means I purg'd it indifferent well from its *terrene* parts; for what Earth or Stones I could not pick out of it before, or at the pounding, being reduced to a powder came through the *Searce*, the *Linum* remaining. Having thus pounded it and cleansed it, I brought it to the *Paper-mil*; and putting it in water in a vessel just capacious enough to make *Paper* with such a quantity; I stirred it pretty much, and desired the *workmen* to proceed with it in their usual method of making *Paper*, with their *writing-paper Mould*: onely to stir it about ever before they put their Mould in; considering it as a far more ponderous substance than what they used; and that consequently if not immediatly taken up after it was agitated, it would subside. *Paper* made of it proved but very coarse and too apt to tear, whereof I have sent you a Sheet. But this being the first tryal, I have some reasons to believe it may be much improved; nor did the *workmen* doubt but in case it were pounded in one of their *Mortars* for 20 Hours space it would make good *writing-paper*; which, when I shall receive a sufficient quantity of it, I design to try. In the mean while be pleased to accept of this superficial account of it, in token of gratitude from

Your most oblig'd Servant

E. LORD.

*Specimen UNIVERSÆ REI NUMMARIÆ ANTIQUÆ,
Or an Essay towards an universal History of ancient
Coynes and Medails, by Andreas Morellius. Paris in
Octavo, 1683.*

THis ingenious and diligent Helvetian, as a fair instance what humane industry may effect, it fixt and resolv'd, hath already delineated above twenty thousand different and ancient Coynes, which is a very considerable part of the sorts reserved in the Cabinets of the Princes of Europe, and alsoe an admirable advantage to the Philologist.

This Specimen divides into fourteen Tables, as into so many curiosities, and is prefac't with the just commendation of the Design, and with a short account of the more famous Collectors of such Antiquity. Amongst these, since the restoring of Good learning to Europe, none deserves more honour then *Hubertus Goltzius*; who, besides the Coynes of Augustus and others already published, had drawne off most of the Imperiall, yet preserv'd in the hands of the worthy Councillour *Chifflete*. *Occo* indeed, and since him the very illustrious *Count de Biragues*, have given the world the writing and Motto's of severall thousands of old Coynes, yet without their figures, devises, and moduls. Here alsoe the candid Morellius largely acknowledges the favours and supply of Doctor *Charles Patin*, the best deserving in that precious Art of all men now living; and after a due admiration of the vast store of ancient money and medails in the closets of the most Christian King, and in severall noble cabinets at Paris, he distributes the whole stock into these parts or Tomes. 1. The Coynes of Cities and Kings, before the times of the Cæsars, or at least without reference to them. 2. The Consular Coynes. 3. Those of the Roman Emperours. 4. The Coynes of the Hebrews, Phœnicians, Moors, Parthians, Arabes,

Arabes , Spaniards , Gothes , and others , which either want inscriptions , or are not easy to be interpreted.

Now the series of Coynes of the Roman Emperours , partly Greek and partly Latine , descends from *Julius Cæsar* to *Heraclius* : for after that valiant, though unfortunate Prince , Barbarity invaded the Mint as well as the Empire. Of these , the Latine are placed , as much as possible , according to order of time. Because after *Gallienus* , it is very difficult to adjust the money to the years , although *Occo* hath attempted it. But as to the Greek Inscriptions of the same Emperors , which are indeed the greater number , it is most convenient to place them according to the Alphabete of the Cities that coyn'd them ; not neglecting the Chronological descent , where it is certain. Yet if the order observ'd for his private use may better please the skill'd , he is ready to follow it in the general work. It is this. 1. The Coynes of the greatest size. 2. The Greek after the Alphabet of the several Cities. 3. The Greek bearing the annual Date. 4. Inscriptions Military, Historical and Provincial. 5. Titles. 6. Deities. 7. Virtues , Attributes, and Acts. 8. Tribuneships and Consulates. The Metal, Module , Rarity , and Cabinet, is noted upon each Coyne : and every Copper Plate contains 35 such Coynes : the Geography, Chronology, and Explanation requisite to this large Atcheivement being added to each Plate. Thus the Preface.

The first Table represents three medails of the greater size. Whereof the first is the Type of the Community of the XIII Cities of Rhodes in honour of the Emperor T. *Ælius Hadrianus Antoninus Pius* , while *Claudius Fronto* was Prytanis or Major of Rhodes, *Afronha* and Pontife : bearing in Reverse the Flambeaux of *Ceres* drawn by a pair of Dragons, sutable to *Ophiusa* the more ancient name of that Island. The next large Coyne shews the laureate Crown of *Marcus Antoninus*, and on the

the contrary part the Musical Orpheus with his charm'd Brutes. The third opposeth to the head of M. Commodus Antoninus, as the consequent and merit of his victories, the harp of Apollo Palatinus.

The second Table likewise gives three large medails: the first suppos'd of Caracalla or Elagabalus amongst the baser Antonines, though perhaps somewhat elder, with this special Reverse, *ἐφ' ἑσίων μέγαν ἀπασῶν τετραχίς νεωκόρον*; where also the Emperor stands in devotion before Diana Polymanna of the Ephesians. The second shews us Probus arm'd Capapee, and on the other side Adlocutio Augusti, four Barbarian Princes kneeling below his suggestum.

In the last of this Table we have the curl'd head of the Platonic Philosopher Apuleius, in a Medail turn'd like our Mill d-money: on the backside is a Souldier entring a porch adorned with three human heads, I believe the Temple of Mercurius Trismegistus. Such Philosophical Medails are by the studious referr'd to the time of Honorius, not higher.

The third Table affords a golden Coyne of Gallicnus with the vain Reverse Deo Augusto: with a type Divo Trajano Patri, Father of the Emperor of the same name, and well known in the Jewish wars. An history of the Trajans we may expect from the admirable Foy-Vailant, who lately published the series of the Syro-Græcian Kings from their Coynes. Next the Community of Asia, under Cleo Prætor of Sardes, represents the adopted brothers Drusus and Germanicus, one with the Armes of an Augur, the other with those of a Pontife.

The next Table shews us the height of the Gentile madness in the Title *Deo Augusto* round the laureate head of Octavius. So in *Divus Pater Trajanus*, a person well known in the Jewish war. The following Coyne bears the two adopted brothers Drusus and Germanicus with the Instruments of Augur and Pontife, and on the Reverse

verse the Dedication by the Sardians under Cleo their Priest and in the name of the Asian Community. Then two rare and elegant stamps, one of Marciana Trajans sister, reversed with Maltedia blessing her two Daughters and not well represented by Tristan, otherwise the ornament of this Learning: the other of Titiana wife to Pertinax, having on the farther side Victory with L. A. or the first year of that Emperor, who reign'd but four Months.

The fourth Table begins with a Coyne of the 2 Philips, father and son, and on the averse part *Otacia severa*, suppos'd a Christian Lady. And after represents Trajanus Decius with *Herennia Etruscilla*, non *Saint Orbiana*, Empress and their sons, Etruicus and Hostilian. The faces of the next Medail are *Aur. Commodus Antoninus*, and the parent of Greek Literature *ΟΜΗΡΟΣ ΝΙΚΑΙΩΝ*, seated on his Parnassus, and thus honored by the Bithynians. The like is done under the same Emperor by the Samians for their excellent Pythagoras, pointing in the Coyne to the Celestial Globe mounted on a Column. Then we have *Hero* and *Leander* of the Abydenes from the Cabinet of Cardinal Maximus; and lastly from the Treasure of the French King, the Edessene Governour *Abgarus βασιλεὺς μέγας* in some Medails, standing and offering the image of Victory, and thereby the Parthian submission, to one of the Gordians sitting on his Imperial Throne. For the Roman Empire consisted of free Cities, Provinces, and dependent Kingdomes.

The next Table commences with Trajane, in the L. IE. or fifteenth year of his Empire saluted by Alexandria bearing (usually) her Elephantine head-peice, and two eares of Corne, noting the Frumentum Alexandrinum. Next you have from the Palace of the present Emperor Leopold three horsemen with *Adventus Augustorum*, relating to the third Consulship of Severus

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at the end of the Parthian war. Then followes a most specious Coyne of Faustina, wife of the Pious Antonine, consecrated and drawn ex Senatusconsulto by a couple of Elephants. Against the head of *Antoninus Caracalla* Tr. P. VII. is exprest from a Coyne of the most Christian King, the Triumphal Arche of Severus and Caracalla, so industriously describ'd from the original structure by *Benitinus* and *Bartolus*. Passing by Gallien's Vow *Jovi Victori*, and Probus his reverse *Origini Aug.* with the Wolfe and first pair of Romans: an Eagle rounded with ΑΠΕΡΩΣΙΣ shews the consecration of ΘΕΟΣ ΚΑΡΟΣ ΣΕΒΑΣΤΟΣ, in a Coyne of Mr. Warner of Berne. This Table ends with the *Felix Processus Consulatus VI.* of the great Constantine, a rare monument in the hands of the *Sieur de Monieux*.

The sixt plate begins with Trajane ΣΩΤΗΡ ΤΗΣ ΠΟΛΕΩΣ, meaning the monument of his Dacic Victory, the *Nicopolis* with her towring head on the Averse. And is succeeded of *Julia Pia Augusta*, or *Julia Domna*, mother of the Emperors, mother of the Senate and of the Country.

I omit the arrogant or undeserv'd titles of Valerian and Gallien, as *Restitutor generis humani & conservator pietatis*: as also Vespasian's *Adsertor libertatis publicæ*, within an Oken-wreath: to hasten to the Golden medail of the most noble Constantine, inscrib'd *Salus & Spes Reipublicæ*, stamp't at Heraclea, and weighing six ordinary *Aurei* of the same Emperour. This we owe to the Cæsarean Treasurie at Vienna.

In the seventh we have *Nero's Jupiter Olympius*, *Nero's Jupiter Liberator* C. P. i. e. *Coloniæ Patrensis*, Trajans *Zeus* stamp't at Pergamus, and Domitians Reverse with the Eagle and thunder *Διὸς Ιδαίου*. Then against the head of *Titus Vespasianus*, that of the Alexandrian Serapis cum modiollo, dated L. F. or the third year of Titus. Of the Deity, so propitious to Vespasian, Morellius will give the public in his *Great work* fourescore different
Ectypes.

Ectypes. Considerable are the *Apollo Sanctus* of Pescenninus Niger, and the *Θεὸς πελοποννησίου* of the Nicæans, near of kin to Æsculapius, in a Philosophical habit, behind the head of Antoninus Pius; and lastly the Bonus Genius of *Galerius Maximinus*, stamp'd at Alexandria with the ensign's of plenty and a moon crescent.

The eighth Table exposes the *Ercules*, or *Hercules Victor* of Æmilian, Nero's *Hercules Augustus* from his Colonia Patrensis, the two Postumi their *Libyan Hercules* with Antæus, and *Erymantian* with the bore: then against the head of Aurelius Verus, the serpent *Glyco*, the devise of the false Prophet Alexander, magnify'd by the Paphlagonians, especially at Jonopolis, that is Abonopolis, and sufficiently derided by Lucian the Sophiste. Besides these, the *Βασιλὴς πελοποννησίου* with a female towering head, the figure of Moneta with her scales and cornucopia, circumscrib'd with *Metalli Ulpiani Pannonici*, which mines are yet valuable to the Roman Emperour. And, to conclude, the *Victoria Carpica*, not *Cardica* of Philip.

The 1x. plate contains Nero's *Diana Laphria* or *venatrix* with her bowe, *Diana Leucophry's* Polymanna of the Magnesians in honour of Hadrian, a very beautiful figure of *Ἥρα ἀργεῖα* with Neros head on the front, the *Nemesis of Tianum* with a wheele at her feet, an excellent Ectype of the Temple of Venus Paphia amongst the Sardians, and on the back of *Salonina* an inscription and statue *Beneri genetrici*, as in ancient Coynes occurs. Jubentus, Bolcanus, Renobatus, Bixit, &c. This deity Julius Cæsar honour'd with a Breastplate made with Brittish Pearls. Then *Hispania* with a rabbit at her feet (*Saphan* in Hebrew: whence the Learned Bochart derives the name of the Country) stamp'd in the second Consulate of Antoninus Pius, and at last in honour of Maximian, *Gaudete Romani. Sic xx. sic xxx.* upon the *Tricennalia* of the Prince.

The tenth Table first honours Augustus Cæsar with **CEBACTOZ KTICTHS** of the Nicopolitans, whose ensigne

ensigne was the head of the Calcydonian bore ; and also with a stampe at Mylasa, χαμματαῶντοῦ Ὀφρεῖα, referring to the storys of Labienus reported by Strabo lib xiv. Then we have two Coyne of Gallienus embellish'd with the dignity of Side metropolis of Pamphylia : and against the head of Aur. Antoninus Sagalassus of the Lacedæmonians, Plenty crowning that Emperor: and on the reverse of Gordian, Seleucia ad Calycadnum libera, a fair Greek Coyn amongst the many of the French King.

The xi. Table begins with a Greek Coyn of Antoninus Pius π. π. revers'd with the image of Tarsus metropolis of Cilicia, holding ears of corne in her right hand, and treading upon the river Cydnus. The next expresses Commodus's Lardicea, the rivers Lycus and Caprus running beneath: then Severus his Diana of the Ephesians, beset with the waters of Cayster and Cenchrius, amongst the rarities of the famous Patin: and averse from Julia Domna, the river Rhodius of the Dardanii; and also in another Coyn of the same Lady, Sagaris of the Nicæans, and opposite to Geta, Scamander of the Ilenses. And concludes with a Coyn of Hadrian, whose reverse shews Marsyas Cibotus Apamensium: near which part of Phrygia some will have Noahs Arke to rest, as the learned Falconerius in his discours de Nummo Apamensi.

In the xii. Table, behind a cut of Trajan is ἐξ ἡν καὶ ὁ πύβροια. L. K. or in the 20. year of his Empire. Then a copper Coyn of Otho with ἐκ Διδίαι, bearing a cap on her head and a garland in her hand. A medail of Antoninus Pius with the Ægyptian ἐν θνία, holding corne in her apron, and leaning upon a Sphinx, stamp L. B. Next Hadrian's Fortuna Spes cos. iiii. upon the adoption of Ælius Cæsar. And also Commodi magnificencia; and yet higher, The world is happy in Commodus, say the Nicæans, κομδὸς εὐαὐδὸντοῦ ὁ κόσμου δωχῆ. To this, an excellent Coyn of Caracalla, revers'd with the four boyes for the seasons of the year, δωχῆς καίτοι, bearing the flowerbasket of the spring, the sickle of summer, the grapes and hares of autumn, and the close garment of winter. And in the 3d. Consulute of Hadrian, a golden Coyn with Jupiter in a circle, bearing a bird or Phoenix on a globe, and underneath Secula aurea.

The xiii and xiv Tables contain several ancient Games, as the Asclepia, Soteria, Isthmia and Pythia of Caracalla at Ancyra. Then Comediana of the Nicæans: and Severiana of the Perinthians and the Philadelphia of the same. Next Severiana and

Philadelphia of the *Nicæans*: the *Olympia* and *Pythia* under *Julius Marcus* in the reigne of *Caracalla*; and in the time of *Gordian* the *Cabiria* of *Theſſalonica*: moſt of theſe repreſented with their urnes and palm's. The *Theogamia Oecumenica* of *Valerian*, in the poſſeſſion of Mr *Nedham* an *Engliſh Gentleman*. The *Agon Comœdianus Oecumenicus* at *Tarſus*, *Hadrians Alia* *Pincenſia*: and that memorable *Coyn* in the third *Conſulate*, and *XII. Tribuſhip* of *Severus*, where *Bacchus* and *Hercules* ſtand circumscrib'd with *Ludos ſeculares fecit*, to witt anno *Romæ* 956. *Chriſti* 205. *Chilone & Libone* coſſ. 115. years after *Domitian's* *Seculars*, as *Cenſorinus* rightly: not c x. as *Zoſimus* reckons.

The 15. Table affords *Cyzicus King* of *Propontis*: *Rex Juſta Junior*, and his wife *Cleopatra*, Daughter of *Antonies Cleopatra*: and a rare head of a *Parthian King* with the glorious Titles of βασιλεως βασιλεων ἀρχαυς δεργέτις διχαίς διπαραγός φιλέλληνος. And laſtly a *Coyn* of *Joſeph fil. Job Salahodin*, the ſcourge of *Chriſtianity*, and occaſion of the *Decimæ Saladinæ* decreed in the *Council* at *Paris* 1188. This and 60. other *Arabic medals* are preſerv'd in the *Library* of *St. Genoveſe* at *Paris*.

The 16. Table commences with a rare *Greek Coyn* from the *Euxine* κτήσης τόμος, and on the back a bunch of grapes πειτιῶν. And followed with the horned head of Θεός Ἀμμών, named from *Ham Noahs ſon*, the ſtampe of the *Mytilenians* under the *Prætor Valerius Ariſtomachus*: this with the figure of the Γερουσία ἱεραπολιτῶν or the *Senate*, viz a *Senators head wreath'd*, like to the deſcription of the ſame in *Dio*. And at laſt a choice *Coyne* of δήμου τριπολειτῶν, encloſeing in a garland their feaſts and playes in honour of *Latona*, ἡρώεα πύθια, meaning the *Meandrian Tripolis*. As for *Hebrew Coyne*s he finds very few genuine in the *Princes cabinets*; but many *Punic* and *Parthic*. Of *French Coyne*s, the illuſtrious *Harley* hath the beſt ſtore: and *Ant. Auguſtinus* will ſerve well for the *Spaniſh*. Then he ſhuts up his *Specimen* with 4. *Coyne*s, viz: *Offa Rex Meeritrum*, *Volcæ Arecomicorum*, *Obulco Hiſpanorum*, and a *Punic Coyne* with a ſow and pigs, and with characters like the *Samaritan*. Beſides, two learned letters of his Excellence *Ezechieſ Spanheme* honour this *Specimen*.

An account of the reprinting of Johannes Goedartius DE INSECTIS; cum Appendice ad HISTORIAM ANIMALIUM ANGLIÆ, by Martin Lister MD. and F. R. S.

IT was desired that *Goedartius* and the *Notes* I had added, might be again printed in *Latin*, which for some reasons I suffered; and put it into the hands of one to do it, who had performed it better, but that *sickness* prevented him in the Task.

Having yielded that, I was willing to print with it a second Edition of the *Appendix* to the *History of English Animals*, having some few things with two *Plates* of *Figures* to add, which are new, besides amendments.

Also not knowing, but I might be prevented my self either with sickness, or otherwise, I did permit the same *Stationer* to print off 4 *Plates* more, which I had by me, very exquisitly designed, of the *Beetles* of *England*; and having not the leisure to transcribe and perfect the *Traict* to which they belonged, I did neither number, nor explain them, and therefore I call them *Mute Tables*: yet I am desirous, thereby to incourage, and recommend even bare and naked *designs* of the things of *Nature*; that such persons as are wealthy and much at leisure, and are only willing to please themselves with elegancy of *Picture*, may do good to posterity, in seeing that part of *Natural History* well performed, which otherwise is scarce in the power of private men; whose industry and studies are very often at a loss for want of that necessary help; which if well done, might be by them referred too.

In the *Appendix*, besides the additions, the whole genus of *Musculi fluviatiles* is new described with more exactness.

Also the *Pholas* kind (that is, a certain sort of *shel-fish*) fast inclosed, and that naturally, in submarine *Rock's*

is much enlarged, and the *Animals* themselves are figured in some of them: by which a great objection is answered, of those who assert æquivocal generation, for that these are inclosed in the Rock, every one in a single hole of its own making, so that it was difficult to imagine how they could copulate; but by the figure we are eased of this doubt, for each *Animal* hath a long bodie naturally exerted and extendable to a great length, as may be seen if they are put alive into water; so that we may well imagine, they couple not unlike *earth-worms*, which come out of the ground for that purpose, and extend as much of their body as is necessary to meet a *Mate*; which if it happen to be near, their bodies are most within the ground, if farthar distant, they are accordingly extended.

And after this manner we must think of the *Solen* kind; which are a sort of shell-fish deep bedded in sand, as the other is in the Rock: these, I say, rise up at certain seasons, and by the like body extended, copulate.

AN ADVERTISEMENT.

All persons that have the *Volums* of these *Transactions* intire, are desired to add a stroke in the title page of the preceding *one* to *this*, and make it the XII *Volum*; Mr. *Oldenburgh* having publiht 4 *Transactions* after his *Eleventh Volum*, to which, the six, set forth by Dr *Grew*, being added, as indeed they ought, for that they carry on the old number; they may well pass for the XII *Volum*: so that the two last, for the years 1683 and 1684 must be accounted the XIII and XIV *Volums*.

Errata in *Morellius's Specimen*.

Pag 826. *Afronha* leg. *Afiarcha*. p. 827. *Polymanna* l. *Polymamma*. p. 827. dele the whole Paragraph, The third Table affords a Golden Coyne, &c. p. 829. l. *Berretinus*. Ibid. *Gallienus's*. p. 830. l. *Leucophrys polymamma*.

An Alphabetical Index of the Philosophical Transactions for the year 1684.

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Aged Persons; see *Craven*.

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